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Niles Planing Machines.

The Niles Tool Works, Hamilton, Ohio, have recently brought out an entirely new line of planing machines, built from new patterns throughout; their design having been carefully studied to secure the best results in weight, strength, power, convenience and general efficiency. The aim has been to produce a planer of modern design, calculated to produce accurate work in the quickest time.

These planers are driven by worm gearing; the experience of the builders in building and operating this type of driving mechanism having demonstrated to their satisfaction that it possesses advantages not found in any other method of driving, and that, with the improvements which have been developed from time to time, there is less wear and friction, and more net power delivered to the platen.

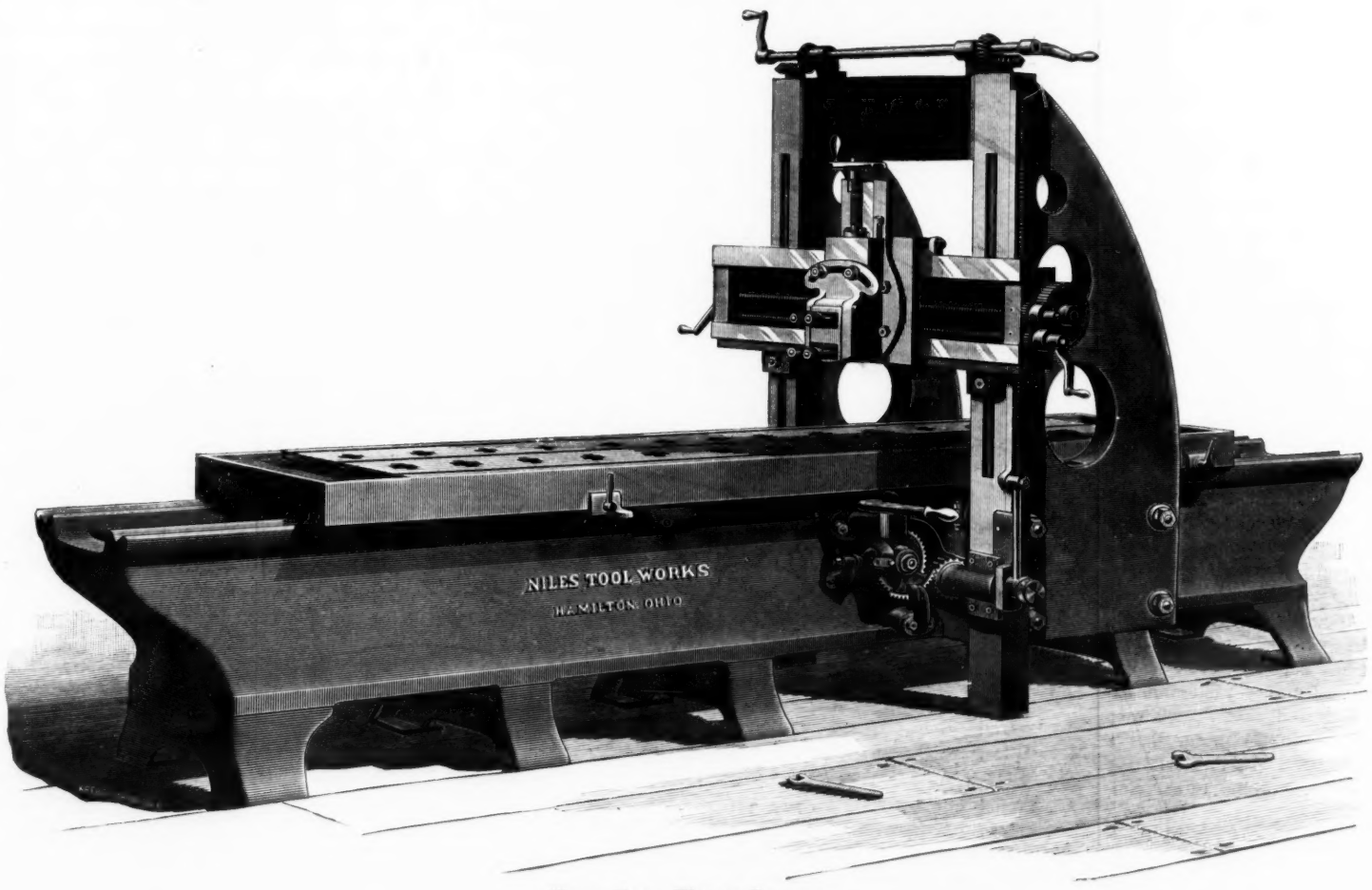
The housings are double-webbed with wide faces. Driving shafts are steel running in brass bearings. Machine sets parallel with line shaft, economizing room in the shop.

The feeds are positive—not by friction—thus avoiding what is often a source of trouble and annoyance. The feed is not operated from the table, but from a shaft, the motion of which is such as is not liable to injure the feed mechanism.

The rail is accurately fitted, and is scraped to a full bearing on the housings.

All sizes below 48 inches have a quick return of *four to one*. The improved mechanism permitting this speed without shock or jar in reversing, and without additional wear on the belts.

All sizes are built, from 26 inches square to 10 feet square, any length. All sizes above 32 inches have power elevating attachment for the rail. They may be had with two heads on the rail and with side heads on the housings if desired.



NILES TOOL WORKS PLANER.

It seems altogether likely that the present record of transatlantic speed will be surpassed before the summer is over. Speed is becoming more and more a prime requisite.

The Watchman and his Allies.

BY C. J. H. WOODBURY.

The proper arrangement and organization of watchmen in mill use is an element of administration which has received scarcely the attention due to a subject upon which depends the care and safety of valuable property at a time when it lacks the usual protection afforded by daylight, and also by a large number of employes.

The stations of the various recording clocks used to obtain systematic as well as honest work on the part of the watchman, are often installed entirely at the discretion of the person selling the same, and with but little consideration to exact matters pertaining to its advantageous use due to each specific establishment.

Passing by the record clock, carried by a watchman, as unworthy of serious consideration in comparison with the electric devices used for such purposes, it may be said that there are three types of electric watch clocks, all of them making their record upon a paper dial situated in a place free from the hazard of the building, so that in the case of difficulty the record may answer the questions naturally asked in respect to the whereabouts of the watchman.

In general phrase it may be said that one type of watchman's electric clock is similar to an annunciator, with the exception that, instead of the ringing of a bell when the knob is pushed, the falling of a drop causes a perforation in a paper dial. Another type may be compared with a city fire alarm system, operated by means of what is technically known as an arbitrarily broken circuit, and the ringing of the bells, with different intervals of time answering to a division of numbers, is simulated in this type of watch clock by a difference in the location of the perforations in the paper. The third form of electric watch clocks does not require any battery, as the current is generated from a magneto placed in each station, so that when the watchman records his work, by placing his key in a hole and turning it around, he produces an electric current in a manner comparable to what is done when one rings a telephone bell; the difference, as in the former instances, being the substitution of perforations of paper on the record, for that of sound as in ringing a bell for a telephone call.

It is well known that fires from spontaneous ignition are very insidious in their nature, beginning slowly and oftentimes bursting out very rapidly and suddenly at the end of a long-continued chemical action of four or five hours' duration. This is particularly true in regard to the spontaneous ignition of black and brown dyed cotton goods, and also cotton waste smeared with animal or vegetable oils. And yet in regard to such instances there have been numerous cases known where the statements of the watchman, and of others who had noticed his presence by the flash of his lantern, and the record of his patrol as shown on an electric clock, all combined in giving evidence enough to hang a man, that the watchman had passed by the site of the origin of the fire at anywhere from ten to twenty minutes previous to its occurrence.

It is probable that the fire began so slowly, and the odor from it was generated so gradually, that the man being all of the time in the mill did not perceive the change of smell until it was too late. Is it not important that a watchman employed inside of buildings should be required to go out of doors at least once an hour, in order to obtain a whiff of fresh air? If conditions are such that there is liability of assault by burglars or other evil doers on leaving the building, this result could be obtained by requiring him to step upon a balcony or fire escape, or even reach out of a window once an hour, the obligation to do that work being fixed by placing one of the stations of the watch clock system on the outside of the building at any of the places indicated.

The recent advance in the invention and practice of automatic fire alarms very naturally gives rise to the questions as to the extent to which it is proper and feasible to recognize the use of such efficient apparatus as substitute for a watchman.

The record of experience seems to show that the automatic thermostatic fire alarm, being always on duty, omnipresent, and omniscient as far as the rise of temperature above the predetermined point is concerned, is a much more efficient indication of the presence of an actual fire than any human being who is obliged to patrol a large establishment, and can see only a small portion of it at any one instant, and then only once an hour.

However, the advantage would be on the side of the man, if, under proper conditions, he should witness the origin of a fire, had it started into actual combustion.

Of the two types of thermostatic fire alarms, the open circuit is the simplest, cheapest, and, if not subject to any derangement, is certainly as satisfactory as any in the method of its operation. The various works, however, can be tested out only *to*, and not *through*, a thermostat, and therefore the confidence in the apparatus is based upon the performance and the permanency of the thermostat, unless it is proposed to try them by the application of heat, as can be done by the use of a cloth wet with hot water at any time desired, care being taken to arrange

that no alarm of fire will be raised by ringing of the bell.

On the other hand, a closed system of automatic thermostatic alarms is always under test as to the conditions of electrical conductivity, but its devices are necessarily complicated, in order to separate the distinction between what are known as accidental alarms, due to breaking of wires, or any physical or electrical interference with the system other than the application of heat.

The method of these various and somewhat complicated devices is to arrange that heat, and heat alone, should cause a fire alarm, while other accidents should produce what is known as an inspector's alarm on a different bell, and in a different location. From the imperfect operation of closed systems in this respect, there have been many false alarms given, to an extent causing distrust in the apparatus. At all events, in good hands all these types of fire alarms can be made to serve a very useful purpose, as has been shown by the numerous instances wherein they have operated for the protection of property.

One instance, worthy of note, in this special connection, is in a grain elevator in Minneapolis, Minnesota, U. S. A., when an alarm from a thermostat near the elevator machinery, in the upper part of the building, was found to proceed not from a fire, but from the heat radiated from a hot bearing; and this enabled parties to attend to the matter, thus preventing a fire. The automatic sprinklers, however, near by, would undoubtedly have performed their work in their customarily efficient manner as soon as the fire would have occurred. But in this instance the operation of the thermostat, as will be noted, was in advance of the fire.

The question as to the proper extent to which these well-known and thoroughly tried devices should be allowed to take the place of watchmen, is worthy of the most careful consideration on the part of the underwriters, and also of owners of industrial property.

The service of the watchman is not merely that of patrolling the property and looking out for incipient fires, but there is a vast amount of what is known as police duty in looking out for neglected windows, water faucets, perhaps inspecting the work of others in regard to emptying the waste cans, to taking due care of the temperature of the building, particularly in the winter months, when any work of that nature must be modified from time to time according to the natural temperature; and, above all, the deterrent effects to evil-minded persons of the presence in a building of a guard, is certainly a matter of great value.

A compromise has been suggested in this respect, by a manager of considerable experience, who considered that for his own uses and purposes he would prefer that a watchman should patrol the inside of the buildings until 10 in the evening, thus giving time enough to discover matters connected with the care of the establishment as indicated above, and then, after that time, the preference would be to rely upon an automatic fire alarm, placing the watchman on the outside of the building, and inside the mill-yard, which, in this instance, was surrounded by a very high and secure wall. Other parties in interest not sharing this opinion, the experiment was never tried.

Without reducing the matter to a question of specific application to any one establishment, it is evident that the thermostatic fire alarms have great value in cooperation with other apparatus, and that, to obtain their full value, requires that they should receive intelligent care. But it is also clear that, in addition to the work of any devices, there remains the need of human intelligence in the supervision and care of property at night, independent of what may be supplied by the very ingenious and practical devices to which reference has been made.

Millions of dollars worth of property have been burned by the lanterns carried by watchmen. The best method is that in vogue at the Lowell mills, where a special gas-pipe has jets at the ends of each room and in entries, giving light enough to enable the watchman to get around without accident.

Watchmen's lanterns should be well made and strongly guarded, the lamp being put in at the top, and never at the bottom, and the whole held together by locked joints of metal, without in any detail relying upon the strength of solder for security.

Making Core Boxes for Fly-Wheels and Band-Wheels.

By P. S. Dingey.

The making of fly and band-wheels is such an everyday occurrence that it seems almost unnecessary to say anything about them, and yet I think something might be said which may benefit some one, or perhaps be suggestive of something better. These wheels are usually cast in halves and bolted together, except in the case of the rim of a fly-wheel, which is generally held together with wrought-iron bands shrunk on each side of the rim, as shown in Fig. 7, or sometimes with cotter bolts, as seen in Fig. 6.

In Fig. 1 the part of the square rim of a fly-wheel, and also that of a band-wheel and two arms are shown. These two wheels are the same diameter, and about the same weight. Let us suppose they are designed for a 16″ Corliss engine; one customer will want a band-wheel for his engine, the next may want a fly-wheel, and because of this it is proposed to make the same arm core box, with some changes, do for the two wheels.

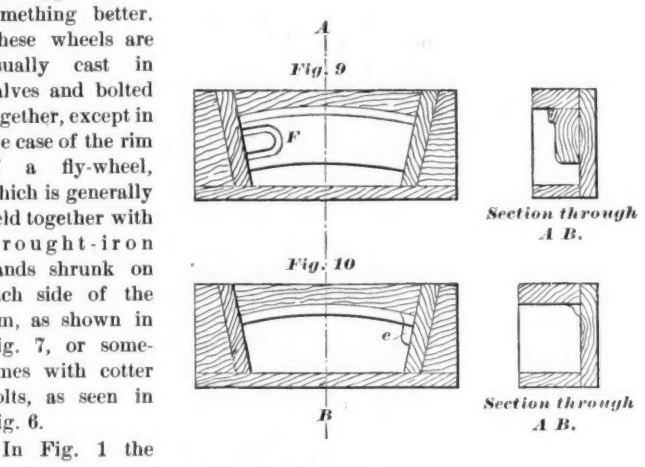
Figs. 2 and 3 are two views of this box arranged for the fly-wheel. Fig. 3 shows one side of the box away. Fig. 9 is for that part of the rim between the arms of the fly-wheel, and Fig. 10 for the inside of rim of band-wheel. The length of these two core boxes is from *a* to *b*, Fig. 1. The outside of both these wheels may be formed with cores, thus doing away with ramming up a cheek and lifting it off.

On referring to the arm core box, Figs. 2 and 3, it will be seen that the piece in the end of box marked *A* is loose to point *a*, so that, when making a band-wheel, that piece can be taken out, and the piece shown in Fig. 5 substituted. Notice that the end must be located further in toward the center for the band-wheel, because, whereas in the case of the square rim wheel the arm core reaches to the outside, in the band-wheel it will only come to the inside of rim as at *b*. See section of rim of band-wheel.

As the hub is to be arranged for bolting together, three loose pieces are made to be used alternately; they are shown at Fig. 8. These wheels having six arms, twelve arm cores are wanted, four of each kind, using the pieces 1, 2 and 3 in Fig. 8. In making the arm core box, care should be taken to make it $\frac{1}{16}$″ off the radial line, that is where the cores join together at the hub and rim. By doing this you will be rendering good support to the home missionary cause, and thus prevent the moulder from using strong adjectives; nine cases out of ten the moulder has to file these cores to get them to come together, and it is very provoking when the last core is tried in, to find that it won't go in place by $\frac{1}{2}$″.

The core boxes for between the arms are seen at Figs. 9 and 10; the ends of these boxes are made radial; that is, the line of the ends run to the center of wheel. This being so that part of the arm core where it joins must also run to the center. Two wedge pieces are therefore fitted against the sides at *c* and *d*, Fig. 2. Changes are wanted in Fig. 10 for the band-wheel, and Fig. 9 for the fly-wheel. The lug *e* that is in the end of box in Fig. 10, and which is for bolting the rim together, must be changed to the other end of box for four cores. After making four from the box as it is arranged, for the remaining sixteen cores, take the lug out altogether; the same will apply to the core print *F* in Fig. 9.

In making the arm cores one-half of them should be swept off flush with the hub for about three-quarters their length. These cores are for the top, and they are swept off because it is easier to set the center core, and also the cores or plates for cutting the hub.



Making Core Boxes for Fly-Wheels and Band-Wheels.

The way we usually split our wheels is to make patterns of plates for the rim and hub about $\frac{3}{8}$″ thick, and get some cast. Before placing these plates in the mould, dip them in a thin mixture of plumbago and kerosene oil; this is found to be a first-rate mixture for keeping the plates from burning into the casting.

A whole pattern is better and cheaper for fly-wheels 9 feet in diameter and under, and, though the pattern itself would cost considerably more than the core boxes I have described, it would soon be paid for by the time that would be saved in the moulding shop. The trouble with patterns above 9 feet diameter is that they do not remain round; also the storage of such large patterns is quite a consideration.

Rules for Gearing.

The Brown & Sharpe Manufacturing Co. have issued, for distribution among mechanics, a card of a size convenient for the pocket, and which has upon one side a list of the firms keeping their standard gears in stock, and on the reverse side all the rules necessary for determining the pitch, diameter, number of teeth, distance between center etc., of spur gears by the diametral pitch system. While the rules are, of course, familiar to those having much to do with gearing, there are many who will find the card a convenient thing to have about. We append some of the rules given:

"Having the number of teeth and the diametral pitch, to obtain the pitch diameter divide the number of teeth by the diametral pitch.

"If the number of teeth is 40, and the diametral pich is 4, divide 40 by 4, and the quotient, 10, is the pitch diameter.

"Having the number of teeth and the diametral pitch, to obtain the whole diameter or size of blank add 2 to the number of teeth, and divide by the diametral pitch.

"If the number of teeth is 40, and the diametral pitch is 4, add 2 to the 40, making 42, and divide by 4; the quotient, 10½, is the whole diameter of the gear or blank.

"Having the number of teeth and the diameter of the blank, to obtain the diametral pitch add 2 to the number of teeth, and divide by the diameter of the blank.

"If the number of teeth is 40, and the diameter of the blank is 10½ inches, add 2 to the number of teeth, making 42, and divide by 10½; the quotient, 4, is the diametral pitch.

"Having the pitch diameter and the diametral pitch, to obtain the number of teeth multiply the pitch diameter by the diametral pitch.

"If the diameter of the pitch circle is 10 inches, and the diametral pitch is 4, multiply 10 by 4, and the product, 40, will be the number of teeth in the gear.

"Having the whole diameter of the blank and the diametral pitch, to obtain the number of teeth in the gear multiply the diameter by the diametral pitch, and subtract 2.

"If the whole diameter is 10½, and the diametral pitch is 4, multiply 10½ by 4, and the product, 42, less 2, or 40, is the number of teeth.

"To obtain the distance between the centers of two gears add the number of teeth together, and divide half the sum by the diametral pitch.

"If two gears have 50 and 30 teeth respectively, and are 5 pitch, add 50 and 30, making 80, divide by 2, and then divide this quotient, 40, by the diametral pitch 5, and the result, 8 inches, is the center distance."

Mr. William H. Weightman, who has been engaged during the past winter in teaching an evening class in steam engineering at the Young Men's Institute, 222 and 224 Bowery, informs us that the class has been in every way a success, and that it will be continued, beginning next October. We learn from other sources that Mr. Weightman's system of teaching has been such as to commend itself to the students, and that their appreciation of his efforts found expression in a valuable testimonial.

The reporter who wrote up the exhibits at a fair, and described a locomotive made of candied peaches as "tooty fruity," is at present unemployed.—*Fireman's Herald.*

Practical Drawing.

BY J. G. A. MEYER.

SEVENTY-SEVENTH PAPER.

559. In the foregoing examples we have purposely left out of consideration the position of stay bolts and braces; because the positions of these should always be plainly marked on the drawing before it is sent into the shop, and therefore the marking of the position of the stay bolts and braces on the plate is simply a matter of following the instructions indicated by the dimensions on the drawing.

560. The numerous examples in laying out boiler work given in the foregoing papers we believe to be sufficient for the student to obtain a good conception of the methods to be followed in laying out a plate for a cylindrical shell; if these examples have been carefully studied, and if the solution of the geometrical problems given previously, to which all practical examples of this kind can be reduced, are thoroughly understood, the student will be able to lay out any kind of cylindrical work with perfect confidence in his ability to do so correctly.

PYRAMIDS.

561. We shall now take up the solutions of problems relating to that class of solids called "pyramids." This course will gradually lead to the solutions of problems relating to the class of solids called "cones."

Definitions.—562. A pyramid, Fig. 471, is a solid formed by several triangles *V G H*, *V H K*, *V I K*, *V I G*, which meet in a common point *V*, and extend to the sides of a polygon *G H I K*. The point *V* is the vertex of the pyramid; the triangles which meet in this point are the lateral faces of the pyramid; the lines *V G*, *V H*, etc., in which the lateral faces meet, are the lateral edges, and the polygon *G H I K* is the base of the pyramid. From the foregoing it will be seen the lateral faces of a pyramid are always triangles; the base may be a polygon of any number of sides.

563. The altitude of a pyramid is the perpendicular distance from its vertex to the plane of its base. It will be well here to draw attention to the expression "*plane of its base.*" In Fig. 471 the line *Vw* may be said to represent the altitude of the pyramid; in this case the altitude is the perpendicular distance from the vertex *V* to the base *G H I K*. In Fig. 472 (which represents another pyramid) the vertex *V* falls outside of the base *G H*; in this case it may be said that the altitude is represented by the line *Vw*, which is the perpendicular distance from its vertex *V* to the *plane of the base*, that is to say, to the plane of which the base *G H* is a part.

564. A right pyramid is one whose base is a regular polygon and the perpendicular let fall from the vertex upon the base, passes through the center of the base. By referring to Art. 133 we see that a regular polygon is one whose sides are equal each to each, and whose angles are equal each to each; hence, if, for instance, the base is an equilateral triangle, or a square, or a hexagon, such as is shown in Fig. 102, and a line *Vw* from the center *w* of the base, perpendicular to the same, passes through the vertex *V*, the pyramid is said to be a right pyramid; and the line *Vw* is the axis of the right pyramid.

565. The slant height of a right pyramid is the altitude of one of the triangles which form its faces. Thus, for instance, if (in Fig. 471) a line perpendicular to *G H*, and passing through the vertex *V*, be drawn on the face *V G H*, the true length of this line (not its projected length) will represent the slant height of the right prism.

566. The convex surface of the pyramid is the sum of its lateral faces. For instance, the convex surface of the prism (Fig. 471) is the sum of the triangles *V G H*, *V H K*, *V K I* and *V I G*.

567. Fig. 471 represents a perspective view of a right pyramid whose base is a square; the outlines have been correctly drawn according to the rules of perspective. A drawing of this kind gives a good idea of the appearance of the object, and serves well for an illustration. But it is not a good drawing to give to a workman, because it does not convey the positive information such as the workmen require; for instance, examining the base *G H I K* we are left in doubt as to whether a square base is meant or not; and this is not the only doubtful item. On the other hand, a drawing like that in Fig. 473 conveys all the information required by the workman. The student will notice that the representation of the pyramid in Fig. 473 has been drawn according to the principles of descriptive geometry explained in Arts. 210 up to 258. In examining Fig. 473 we will find that the line *Vw* gives the correct altitude, or, in this particular case, the correct length of the axis of the pyramid. Now, further examination will reveal a very important fact, namely, in this particular case the lines *V G* and *V H* do not show the correct length of the lateral edges of the pyramid; indeed, we will find that these lines are shorter than the edges which they represent. Let us now endeavor to find the reason for this fact; in so doing some of the principles stated in previous articles will be brought more prominently to our notice: the principles here involved are very important and should always be kept in mind, so as to enable us to read a drawing correctly, and prevent us from falling into error, not only when we have to interpret a drawing of a pyramid, but also, of objects of widely different character. The principles upon which practical drawing is based have been given in previous articles; yet, in order to give as clearly as possible the reason for the shortness of the lines *V G* and *V H*, it will be well to give here a brief summary of the principles involved.

Fig. 475. Let *Y* represent the edge of a drawing-board standing vertically, and let *X* represent the edge of a drawing-board occupying a horizontal position, and let the face $B_3\ D_3$ of the board *Y*, and the face $B_3\ F_3$ of the board *X* represent respectively the vertical and horizontal plane of projection; also assume that the drawing-boards are hinged at B_3, so that they may be opened like the cover of a book. Let $V_3\ H_3\ K_3$ be a given pyramid of which a drawing is to be made, or, in geometrical language, let $V_3\ H_3\ K_3$ be a pyramid whose vertical and horizontal projections are to be found. To find these projections, we assume the pyramid to be fixed in any given position above the horizontal drawing-board *X*, and at any given distance in front of the vertical drawing-board *Y*. For our present purpose, we shall assume that the base of the pyramid is placed parallel to $F_3\ B_3$, and the edge $H_3\ K_3$ perpendicular to $B_3\ D_3$. Let Fig. 476 represent the same drawing-boards and pyramid as they will appear when looked at in a direction indicated by arrow 1. Now, according to former articles, in order to find the vertical projection, we assume that planes perpendicular to the vertical plane of projection $B_3\ D_3$, Fig. 475, are passed through all the edges of the pyramid; the lines in which these planes intersect the vertical plane $B_3\ D_3$ (the line $v_4\ h_4$ is one of the intersecting lines) will form the vertical projection, or, as it is often called, the elevation of the pyramid. Again, we assume that planes perpendicular to the horizontal plane of projection $B_3\ F_3$ are passed through all the edges of the pyramid; the lines in which these planes intersect the horizontal plane $B_3\ F_3$ make up the horizontal projection or plan of the pyramid.

If we now remove the pyramid and open out the drawing-boards, for instance, like the cover of a book, so that the surfaces $B_3\ D_3$ and $B_3\ F_3$ will lie in one plane, or form one surface, then the boards with the lines in which the projecting planes intersected the planes of projection will appear as shown in Fig. 477; $v\ g\ h$ will be the vertical projection or elevation of the pyramid, and $v_2\ g_2\ h_2\ i_2\ k_2$ will be the horizontal projection or plan of the pyramid.

We are now in a position to account for the shortness of the lines which represent the edges of pyramid. Notice, for instance, the edge $V_3\ H_3$ in Fig. 475; this edge, as will be plainly seen, is not parallel to either plane of projection $B_3\ D_3$ or $B_3\ F_3$, and therefore its vertical projection $v_4\ h_4$ cannot show the true length of the edge. (See Arts. 243, 244, twenty-fourth paper). Again, the edge $V_3\ H_3$, and also its projection $v_4\ h_4$, lie in the same projecting plane; the line $v_4\ h_4$ forms right angles with the parallel lines $V_3\ v_4$ and $H_3\ h_4$, drawn on the projecting plane; the edge $V_3\ H_3$ also terminates in the lines $V_3\ v_4$ and $H_3\ h_4$, but does not form right angles with these lines, therefore, $V_3\ H_3$ (the edge) must be longer than $v_4\ h_4$ (the projection of the edge). Lastly, the line $V_3\ w_3$ represents the axis of the pyramid, and, because the base $H_3\ K_3$ is perpendicular to the vertical plane of projection, the axis $V_3\ w_3$ must be parallel to the same plane of projection, and because the line $V_3\ w_3$ is parallel to $B_3\ D_3$, its projection on the plane $B_3\ D_3$ must be the true length of the axis; and since the axis also represents the altitude of a right pyramid, the projection of $V_3\ w_3$ will also be the true altitude.

From the foregoing remarks, we must not conclude that it is impossible to make a drawing which shall show the true length of the edges of the pyramid. Since we can place the pyramid in any position we may choose, we can place the particular pyramid under consideration with two of its edges parallel to the vertical plane of projection, as shown in Fig. 478. In this figure the edge $V_3\ H_3$ and the opposite edge are parallel to plane $B_3\ D_3$, and, consequently, the vertical projection of these edges will show the correct length of the same. By placing the pyramid in a position as shown in Fig. 478, we obtain an elevation and a plan of the pyramid similar to those in Fig. 474. Here the lines *V G* and *V K* show the correct length of edges of the pyramid.

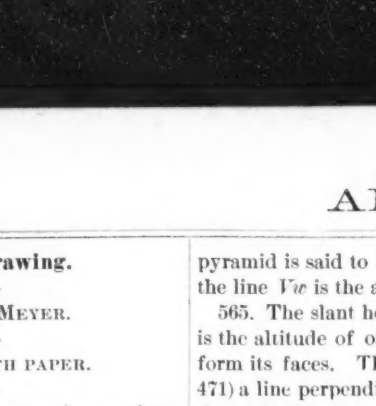


Fig. 478

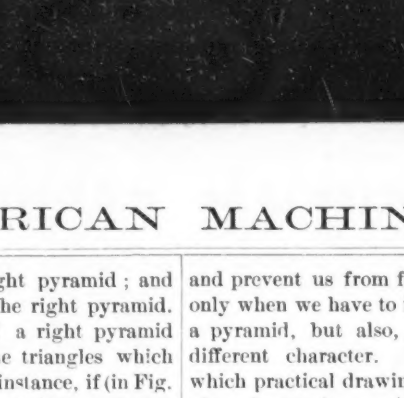


Fig. 475

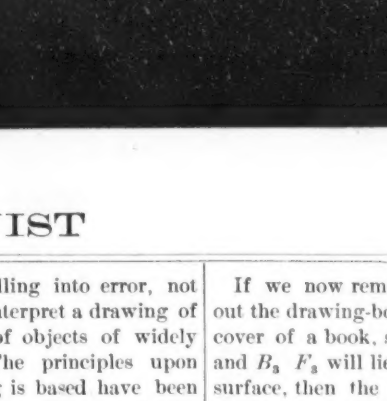


Fig. 476

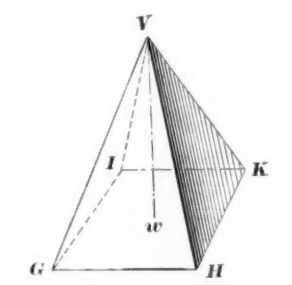


Fig. 471

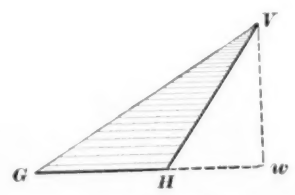


Fig. 472

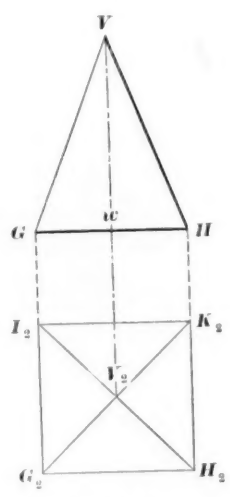


Fig. 473

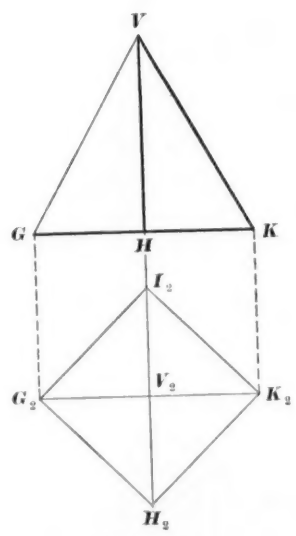


Fig. 474

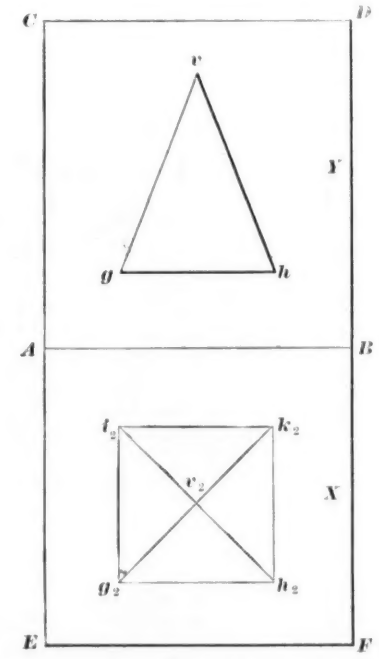


Fig. 477

PRACTICAL DRAWING.

The rapid institution of mills, furnaces and manufactories in the Southern States is calling attention to the natural resources of these States. Thus we learn that while the State of Texas is a cattle-raising and a wool growing State, and raises more cotton than any other State, yet there are 25,000,000 acres of pine forests within her borders, and iron in large quantities.

It is said that the French Government is in possession of fifty-one torpedo boats that are practically useless. These boats were built by contract, in great haste, and by several firms which would not guarantee the speed of 20 knots called for. The boats cannot make that speed, and are unseaworthy.

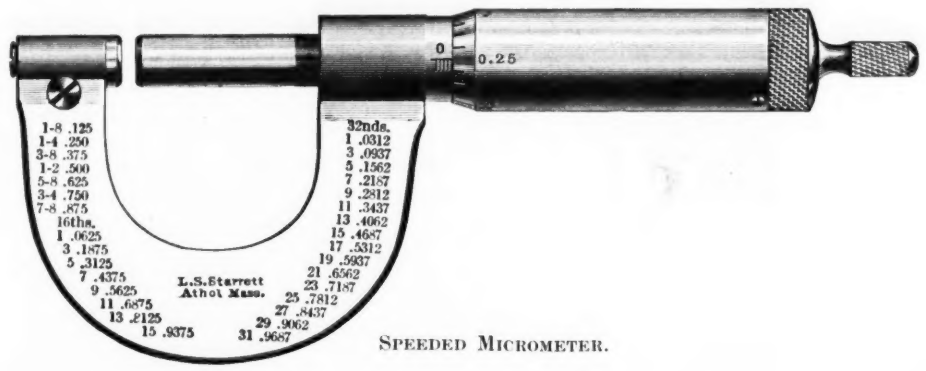
Starrett's Speeded Micrometer.

Accompanying this is a full-size cut showing an improved micrometer caliper made by L. S. Starrett, Athol, Mass.

Every one familiar with the micrometer knows that, if it has to be used on work varying in diameter an amount nearly equal to the capacity of the tool, it becomes a tedious operation to turn the screw back and forth, some mechanics taking the barrel in the hand and swinging the instrument rapidly around it, to facilitate the operation—a plan which has been found to have its disadvantages.

In this instrument a knurled thumb-piece or stem is added to the end of the barrel, which is comparatively small in diameter, and can therefore be turned between the thumb and finger quite rapidly; in fact, about three times as fast as without it. It is also thought by some that it adds to the sensitiveness of the instrument, because the leverage is reduced and the power of the fingers to turn the screw against a resistance lessened.

The screw is entirely covered and protected, and the thread, which is ratchet-shaped, runs nearly through the barrel. There is a spiral spring which gently forces the screw back, and takes up all lost motion, maintaining a solid abutment between the working faces of the screw and nut. This obviates the necessity of splitting the nut to contract it for adjustment, making it easier to keep out all dirt and grit. The contact surfaces are so formed and arranged as to make it possible to measure close up to a shoulder when required, and a table of decimal equivalents is stamped upon the bow.



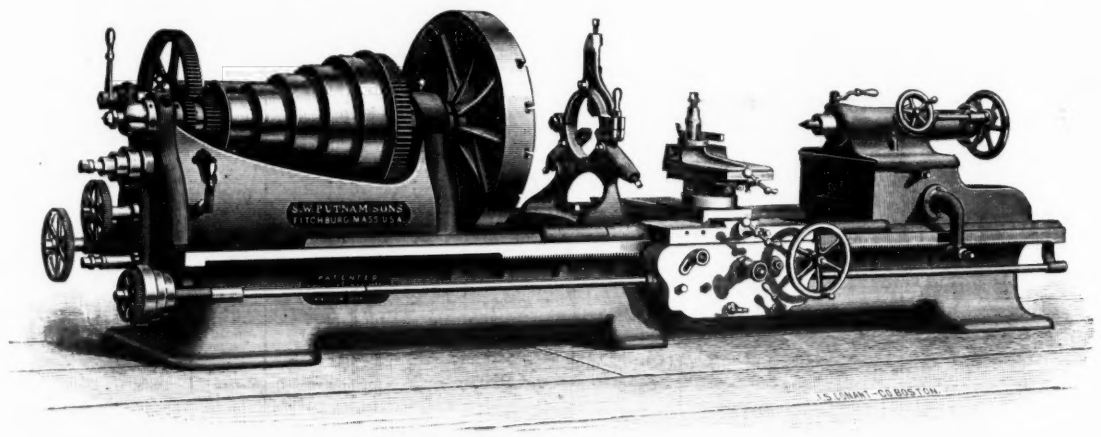
Speeded Micrometer.

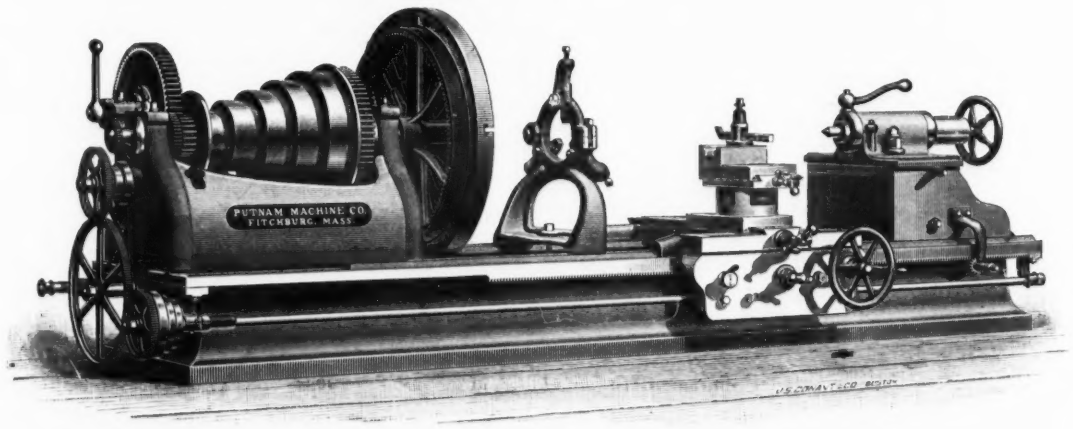
Forty-six and Forty-eight Inch Lathes.

The illustrations on this page are of a 46″ and a 48″ lathe, built by the Putnam Machine Co., Fitchburg, Mass.

It will be noticed that there is considerable difference of design between the two, which is accounted for by the fact that, though now built by the same company, they are built in different shops, which, previous to a recent consolidation under the name given above, were owned by two separate companies.

The upper one of the two cuts is of the 46″ lathe, which has a number of features peculiar to itself, among which are a bed, the section of which is semi-circular at the bottom, with cross-ribs, and a central rib or back-bone running through its entire length; an extra large V in front to support the extra weight and strain; boxes which are adjustable by endwise movement, affected by nuts, and which can be turned in the head to equalize the wear and preserve alignment; rollers pressed upon the inside Vs by springs, to relieve the weight of the foot-stock when it is to be moved, and a device for increasing the feed for surface cuts, by throwing the pinion on the stud forward to make it engage with the pinion on the cone pulley. The direction of the feed is reversed in the carriage apron, and the lead-screw nut is opened and closed from the front.





Forty-six and Forty-eight Inch Lathes.

The five steps of the cone pulley, together with the back gears, are so proportioned as to give a uniform ratio of increase of speeds from the slowest to the fastest.

The feed may be either by belt or gearing, and the rack pinion may be disengaged when cutting threads. There is a side-wheel for operating the foot-stock spindle and a pinion engaging the rack for moving the block. Both lathes are triple-geared, having a pinion engaging with an internal gear on the face plate, and are made with various lengths of bed, from 10 to 30 feet.

The "City of Paris."

During the time that the "City of Paris" remained at her pier in the North River, after her recent fast run across the Atlantic, she attracted much attention, and was visited by many people who greatly admired the magnificence displayed on every hand, and minutely inspected the cabins, state-rooms, library, etc., apparently finding nothing to criticise, but much to wonder at and admire.

The engine-room was the objective point for a representative of this paper, and stepping in from the upper deck he found himself upon an iron balcony, which is above and surrounding the space assigned to the starboard engine. The double piston valve, which controls the admission of steam to the third or low-pressure cylinder, had been pulled out, and hung suspended from the small traveling crane above; and down in the valve chest, and completely hidden from view, was a man with a torch, who, when he emerged, proved to be Mr. J. B. Cousins, one of the second engineers. In reply to a question, Mr. Cousins said there was nothing at all the matter with the valve, but that all of them had been taken out to see that nothing was the matter with them. During the trip over there had not been a moment's delay on account of the machinery; everything had worked perfectly, and absolutely without heating. Yet it was thought that still better time would be made by the vessel before the season ended, for the reason that the machinery had hardly been in use long enough to be at its maximum efficiency, and, as is the case with all new ships, there were points to learn as to the best possible manner of handling her, which only experience with that particular vessel could teach. The proper management of the forced draught had to be developed by trial; during the first trip a pressure equal to one inch of water nad been used, but during this trip it had been reduced to five-tenths of an inch with much more satisfactory results. The probabilities are that several trips will yet be made before the exact pressure for the best possible performance is ascertained.

The vessel having twin screws, there are two engines which stand side by side, separated, however, by a water-tight bulkhead. They are of the triple expansion type, the cylinders, which are 45″, 71″ and 113″ diameter, being placed fore and aft. The stroke is 5 feet, and it is expected to turn the shafts at 90 revolutions, though 88 is about the best which has so far been done, giving about 20,000 horse-power in the two engines. There are 9 double-ended boilers, carrying a maximum pressure of 150 lbs., the usual working pressure being about 148 lbs. Not all of this steam is used for the main engines, however, there being numerous other smaller engines about the ship used for various purposes, such as electric lighting, for which there are four compound engines of 50 H. P. each. Then there is a 200 H. P. engine on each side, for forcing water for use in hydraulic machinery, of which a great deal is used for elevators, cranes, etc. The anchor is weighed and the vessel steered by hydraulic power. There are altogether 21 engineers and 32 oilers, while to keep up the fires 57 firemen are required. To keep the engines lubricated 16 gallons of oil is used in each watch, or 96 gallons a day. Above the engines, and midway between them, is an engineer's storeroom, in which are kept the various tools and minor supplies, back of which is a complete machine shop, having in it a lathe, a drill press and a shaper. The British Government has the right to claim the services of this vessel in time of war, and she is therefore fitted for carrying guns, the provision made for this being plainly perceptible from the main deck. The man who steers the vessel may be at any one of three different points, one of these being far below the water line, near the stern, where there is an engine and all necessary appliances for the purpose, out of the reach of an enemy's shot.

When a vessel makes a phenomenal run the newspapers talk about the captain, and he is lionized and congratulated on every hand, as though the performance was entirely due to him. A good run is due to the skill and ability of the captain of a vessel in somewhat greater degree than a good run by a railroad train is due to the conductor; because upon him depends the navigation; but the main dependence for speed must always be first in the designer and builder of the vessel and her machinery, and, second, in the men who handle that machinery, and who, when the engine is in port, are found in the valve chests and cylinders examining things to see that all is right, and who, during a voyage, stand at the throttle, watch every revolution, and constantly study to anticipate difficulties and avoid them; keeping the engines up to the highest possible performance for every moment of time, night and day throughout the voyage.

The Modern Steam Plant and its Management.

By Peter H. Bullock.

REPAIRING VALVES.

Recently I received a letter from a young man in New Hampshire, who says he is running a portable saw mill engine, and that the 2⅛-inch throttle valve leaks. (This is probably his outside measurement of a 2″ pipe.) He says, "You have told all about leaky valves, and why they get so, but not a word about the way to fix them."

Recognizing the truth of the latter statement, and wishing to be of service to any young man that is earnestly trying to learn, I will go back to valves long enough to tell how to repair leaky ones.

In sizes of valves up to and including ½ inch, the stem and disk are usually cast solid together, while above that size the disk is usually secured to the stem by means of a nut with threads on its outside. When a valve is to be repaired that is to remain in its place in the pipe, and has been unseated, let the first thing you do be to fill the space below and each side of the seat with waste, to catch any material that is used for grinding, or that may be cut from the seat. If, upon examination, it is found that the disk has been cut or worn away, but that the seat is in fairly good condition, it will be in order to take the stem from the stock, and the disk from the stem, if it be detachable. If the stem and disk are solid, you can cut a notch in a block of wood for use in a vise or in the edge of a bench or box to rest the stem in, and then taking a second-cut file in one hand, with the stem in the other, file across the disk at the same angle it was originally turned, moving the stem around all the time. When all the marks are filed out, moisten the end in oil, and dip it in some fine emery or other suitable substance for this purpose, and turn it around a few times on its seat, and then remove and wipe it. The stem can usually be held for this purpose in a common bit

brace with chuck jaws. On examination, you will see that there are marks a part of the way around, where it has ground against the seat. Now you must file the marks off and try again, doing this till there is a mark all the way around. If you have a speed lathe with an adjustable chuck, you can hand-tool the disk instead of filing. By wiping the seat you can see whether that is cut or grooved, or if the disk has a bearing all around; if so, use a little flour of emery, rubbing the surfaces together till they are both good and smooth; then thoroughly wipe all the parts, put together, and the job is done.

If the seat is found to be cut, it may be necessary to use a scraper, and if very bad, a beveled mill made for the purpose. There are in the market, valve-grinding machines that have beveled mills for all sizes of valves, spindles for holding the disks and bushings for holding the spindles in line with the seat when grinding. They are very convenient, but comparatively few engineers have them to use.

If the disk is attached to the stem by means of a nut, it will have to be taken off and secured to a spindle for holding and grinding, as described for smaller sizes. If you start to grind a valve, don't give up till you have done it. There are many ways for holding the disk. I have seen a good job done by holding the disk or a piece of broom handle with one end whittled down square to fit an old-fashioned bit stock. Some have spindles made with enlarged heads, and threaded to fit the different sizes of disks. Sometimes you may want to grind a valve when you have none of these things, and little time to rig up anything. In a case of this kind, get the disk off the stem, put a piece of rubber packing or leather about the size of a cent under it, and screw it into place again. Now hold the stem-stock and turn the stem through till the part that is threaded is clear of the inside thread. The leather will hold the disk stiff enough to file or grind, and the stock can be used as a guide for the stem by holding it in place just above the body with wooden hand-screws. Or, if you have a pretty steady hand, you can do a fair job by simply turning the wheel, stem, and stock all together.

As a material for grinding, emery of different grades of fineness is mostly used, although brass finishers and others use some special kinds of sand. In fact, more depends on how the job is done than in the kind of materials used in doing it. Many a good job has been done with fine beach sand, and also with grindstone dust. If you see printed anywhere that powdered glass is good for this purpose, don't try to make it yourself. I knew an engineer who spoiled two 1½″-plug cocks, trying to grind them with some of his own make.

We will now presume that any valve that you may have had under treatment is done; so let us wipe it clean, pull out the waste that we tucked under and around the seat, put the parts together again, and see how much better it is to have a good tight valve.

I am obliged to my correspondent for calling attention to my neglect, and for asking for what he wanted.

While the fastest passage was being made across the Atlantic by the "City of Paris," the fastest run by water from Buffalo to Chicago was made by the steamship "Oswego," of the Union Steamship line. The time was 58 hours, being two hours and fifteen minutes shorter than the previous best record, which was made last year by the same vessel.

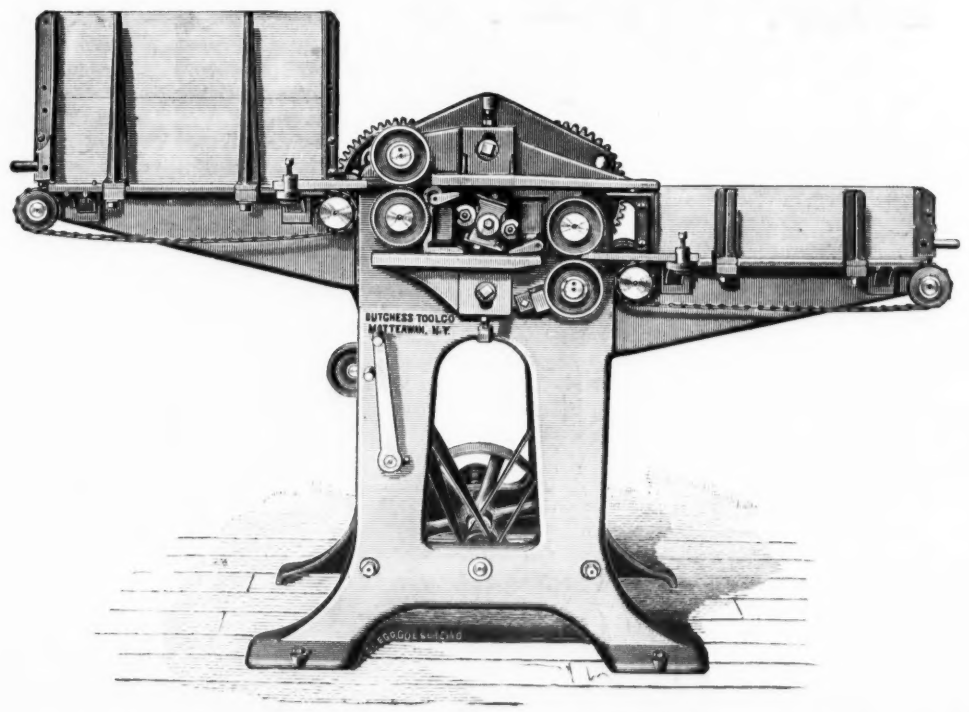
The manner of supplying the rapid-firing guns of the Italian cruiser Piomonte with ammunition is described as "part of a great undivulged secret." But it does not appear to be a secret that she must get in her work very rapidly, as she is extremely vulnerable.

Improved 20-inch Drill Press.

The accompanying cut represents an improved 20-inch drill made by J. E. Snyder, Worcester, Mass. It is made with the lever and hand-wheel feed combined, or with either, as may be desired, having a quick return in any case. By means of a rack and pinion the sliding head has a vertical movement or feeding capacity of 18 inches. The vertical movement of the table is 16 inches, and

its diameter 18 inches. The diameter of the column is 6 inches, and the cone sections 5, 7, 9 and 11 inches, with 2½-inch face. The spindle is 1½ inches diameter, and has a taper-hole which conforms to the Morse taper No. 3.

The greatest distance from spindle to the base is 48 inches, and from spindle to table 32 inches; total weight, 1,000 pounds.



Single Head, Automatic Blind Slat Planer.

In the machine which we illustrate herewith, one head finishes the slat complete on both sides and both edges, a special head being employed for the purpose. Above and below the head are located bed-plates, which are made adjustable so that they may be moved to or from the head for the purpose of dressing slats of different thicknesses. The top bed has a flat surface, upon which the slat slides while being dressed. Pressure bars are located on either side of the head, the one preceding the cut being flat at the point, while the one following the cut is made to conform to the shape of the finished slat. These pressure bars hold the slat firmly to the under flat surface of the top bed-plate. The under bed-plate, over which the slat passes, is made to conform to the shape of the finished slat, as it will be seen that the slat, after passing over the head, is finished on the under side; the top side still being rough, pressure bars precisely the same as the ones used in connection with the top bed are employed in connection with the bottom bed. Upon either side of the head are located feed rolls, each pair rotating towards the head. Two hoppers for the reception of slats are provided—one at each end of the machine. In the bottom of each hopper is a slot, through which travel small chains, upon which are located equidistant pairs of spurs. These spurs extend high enough above the bottom of the hoppers to engage the first slat therein. The chains are driven by small endless belts, an even tension being secured by means of weighted tightener pulleys. The chains travel much faster than the feed rolls, the object of which will be seen later. To each outward end of the hoppers are attached sliding bolts, which, when pressed down, engage one of the spurs and hold the chains stationary, the small belts slipping upon the pulleys. The operation of the machine is very simple. The first hopper (the high one to the left) is filled with slats, which should be grained, *i. e.*, laid so that the cut will be with the grain, care being taken that both sliding bolts are down, so that the chains are held stationary. The head and feed rolls are now started, and allowed to attain their proper speed. Then the bolt is withdrawn, and the chain shoots forward, propelled by the belt which has been slipping, the spur catching the end of the bottom slat and forcing it forward to the first pair of feed rolls. As the slat comes in contact with the rolls, and is caught by them, its speed is diminished to that of the rolls, and immediately there is a slipping of the belt which drives the chain. As the slat is carried out of the hopper, another one drops down and takes its place. Now the spur which is in contact with the first slat, and following it, passes around the sprocket wheel, and, consequently, leaves the slat; and the moment the spur is released the chain shoots forward, propelled by the belt which has been slipping, and the spur opposite to the one just released catches the end of the bottom slat and shoots it forward against the end of the preceding one. Thus the slats are fed continuously to the cutter, with no space between them. As the slats pass over the cutter they are finished on one side and partly on each edge, and are dropped into the hopper to the right, with the rough side up. When this hopper is about three-fourths full, the bolt is withdrawn, and the slats are carried to the feed rolls (second pair) in the same manner as in the first passage described. This pair of rolls forces the slats under the head, finishing the planing and dropping them out of the machine, finished complete. As the same bits finish both sides of the slat, without turning it over, there is no trouble whatever in securing the exact matching of the two sides of the slat; for, of course, it would be impossible to have them otherwise; and as the head is at all times cutting both above and below, the maximum efficiency is secured.

The machine is the invention of Mr. F. H. Van Houten, and is made by the Dutchess Tool Co., Matteawan, N. Y.

Practical Details of Blacksmithing.

By B. F. Spalding.

A HAND BENDING MACHINE—ITS SIMPLE CONSTRUCTION—METHOD OF FITTING AND INTERCHANGING DIES—ITS CAPACITY AND VARIED USES.

It is sometimes very convenient to have a hand press for bending iron in the blacksmith shop, even if there is plenty of steam or water power to be had, for when the operator has the moving power in his hand, it is so completely under his control that he can observe its action as it performs its work, and if it is not producing the desired results he can stop its motion while he readjusts, to the proper position, the piece submitted to its pressure, and again proceed until the required form has been produced. This press is of that class of tools that are so convenient that, when they are once introduced, many things come to be done with them which never would have suggested their use if they did not stand so handily in the way.

The form of hand bending press shown in Fig. 1 (page 6) has nothing remarkable to recommend it, except that it is entirely destitute of all sorts of frippery, and is a very practical, common-sense machine. It was probably devised by a man who never knew he was a good mechanic, but did know that he was in a hurry for its work. It is not in the market for sale; every man makes his own. I have seen a number of copies and improvements, but for a machine that, like an old-fashioned Singer tailoring machine, works as well when it is all worn out as when it is new, I will take the old original; which I will now describe. In the circle in which it is known, it is appreciated, and to widen this circle is to extend its use. It consists of the frame *A*, the ram *B*, the lever *C*, and the post *D*. Only part of the post is shown. It should be a foot square, and eight feet long. Three and a half feet should be very firmly set in the ground; it will then stand out about the right height to make the machine easily handled, and give a good chance to look into the dies, when placing the pieces which are to be formed.

The frame forms a kind of a clamp. The pattern is made of 1½-inch stuff, except the fulcrum arms, which are 2 inches, and the ram guide box, which is 3 inches thick. The throat is 7 inches deep, and the width of the frame gives a die seat 8 inches long. The rib on the back side is let into the post. That on the top is of the same thickness (1½ inch), giving 3¼ inches on each side of it in the head for space in which to drill bolt holes, through which bolts may be put for different lengths of dies. The method of attaching the dies is shown in the figure.

They are generally of cast-iron, and are easily fixed in their proper position if the patterns are well made. Nothing more is necessary, after they come from the foundry, but to put them in their destined places after they have been fitted to receive a piece which is placed between them—and is such as they are intended to make—and scribed through such of the holes in the head as strike them in the best position. Then all that remains is to drill and tap the holes thus laid out, and when the dies are wanted for use there will be nothing to do but to put in the bolts and tighten them up. There will be no trouble about setting them.

If more than one of these hand presses is to be used in the shop, a template should be made of the holes in the head, so that

they may be duplicated on each. Then all dies will fit all presses. There has been much trouble and petty annoyance arising in some shops through not observing this precaution, thus making it necessary to always have the jobs done on the presses the dies were originally fitted to, when, in many instances, it would have been much more convenient to have done them at another.

The ram head should also be drilled to correspond with the main head, and then dies can be used either above or below, as circumstances may dictate. The stem of the ram is 3 inches square, set on diagonally to the head. It is guided by V grooves in the box and cap, through which it passes in square section, but at the point where the rack commences it squares out full four inches wide at the front for the rack teeth, leaving it still angular on the back side, which is kept back into a V groove between the fulcrum arms, by the action of the lever pinion teeth.

The end of the lever which communicates motion to the rack is made of cast-iron four inches thick, and this is patterned in such a manner, back of the pinion, as to afford a strong seat for a wooden handle, three inches square in its largest cross-section. The handle is fitted into the casting, and rounded down at the other end to give a good hand-hold. It is three or four feet long, giving a purchase of 12 or 16 to 1. With some accumulation of energy in the swing of the lever, a fair-sized man can easily give a pressure equal to a ton. This suffices for a large class of work.

Figs. 3 and 4 represent hoe points, such as are used for plowing the furrows for seeding with grain drills. These are largely bent on this style of machine, of steel 2½ inch by $\frac{5}{16}$ inch. Fig. 2 shows a form of point made of 5 inch by ½ inch, which offered so much resistance to throwing out the point, in consequence of the depth from the point to the heel and the width of the material that had to be bent to form the concave in its profile, that it could not be bent on this machine at less than three heats, and not satisfactorily at all. When dies were made for a light drop, it was shaped with great facility, being gauged from the point, and also from the bolt hole, indicated on the illustration, which, having been gauged from the point itself when it was punched, was always at a certain distance from it, and gave definite fixed points to work from—a very essential thing in the reduplication of parts.

With this machine, pieces shaped as in Fig. 5 are easily formed of iron 1½ inch by $\frac{5}{16}$ inch, and, like Fig. 6, of iron 2 inches by ⅝ inch. It can also be used as a welding machine, taking the place of an oliver, for welding rings, eye-bolts, or anything of that description, which it is expedient to have welded between shaping dies. For this purpose it is necessary to set it lower down, so that it will not bring the dies any higher than an anvil. It should be so set that the lever can be seized in the right hand, and the dies so made that the work will enter at the angle at which a man in this position would naturally present it with his left hand.

The "Gem" Foot-Lathe.

We illustrate herewith a new foot-lathe brought out by the Seneca Falls Manufacturing Co., of Seneca Falls, N. Y. It swings 6 inches, takes in 18 inches between centers, and is adapted for turning in wood or metals, boring, drilling, polishing, etc.

It has a patented improvement in the treadle mechanism, by which two treadles are used having alternating motions, being connected to opposite ends of the driving shafts, and to cranks which are opposite each other.

The lathe may be driven by either treadle standing, or both sitting, and they are adjustable along the bar. A 1-inch flat belt is used, and the spindle has a $\frac{5}{16}$" hole through it. Boxes are adjustable for wear. A slide-rest or a countershaft are furnished when desired. The weight of the lathe is 110 pounds.

LETTERS FROM PRACTICAL MEN.

Oiling Cylinders—Expansion Joints.

Editor American Machinist:

The writer's attention was recently called to an oil-cup for steam cylinders that it was claimed would feed water with the oil.

Fig. 1

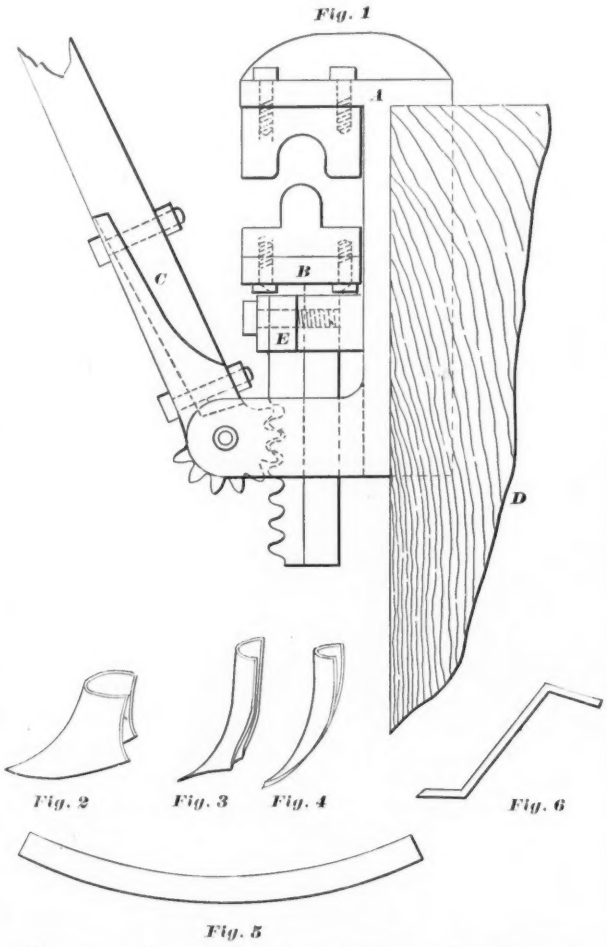


Fig. 2 *Fig. 3* *Fig. 4* *Fig. 6*

Fig. 5

PRACTICAL DETAILS OF BLACKSMITHING.—SEE PAGE 5.

What sort of reasoning would make water fed with oil necessary it was difficult to understand until reading Mr. Booth's paper on the "Friction of Slide Valves." In that it is difficult to see how that an excess of oil could result as stated, unless it was the *quality* rather than the quantity. When an engine gets a dash of water from the boiler, it requires quite a dash of oil right after it.

Something over twenty years ago, while a locomotive fireman, I was called one morning to go to the round-house and go out on "No. 28." After oiling the machine, I took hold of the throttle to run it out of the house, but found it apparently immovable, and, having had some experience with hard-working throttle valves, I concluded to leave it for the engineer. When the engineer came—a stout, brawny man, to whom the engine was strange—he took hold of the throttle, but did not start it; gave it another pull, then looked and meditated. Finally he managed to get it open, and started off on the road. The first time steam was shut off he resorted to the well-known trick of putting a good, liberal quantity of oil in the cylinders—the only time cylinders could be oiled in those days—then reversed the engine, which transformed it into an air pump, to pump air into the boiler until the throttle was lifted from its seat and some of the oil deposited there, when the throttle worked all right.

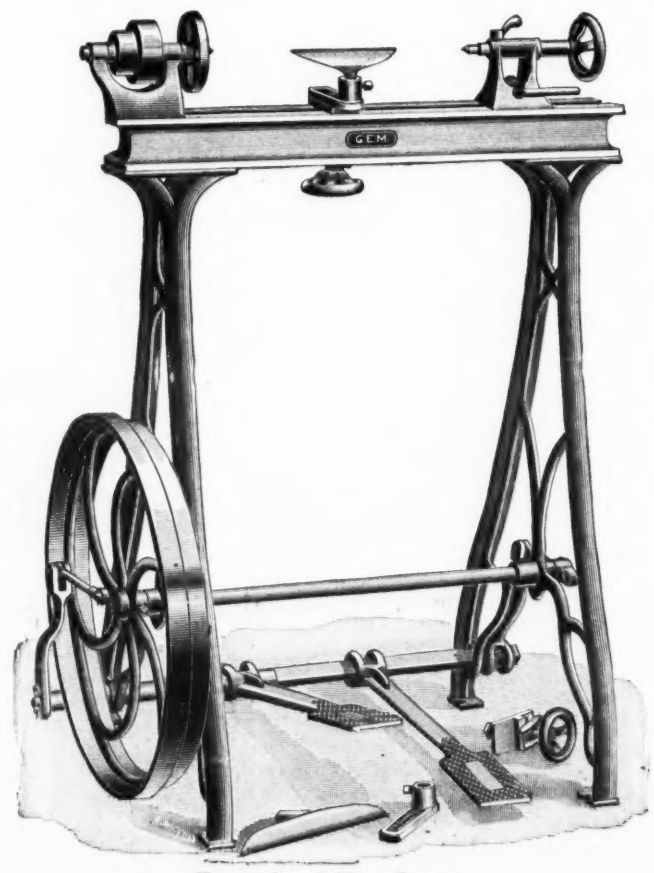
In those days they had no automatic feed, and the amount of oil used was what you could afford. I never knew too much to be used for easy working of the valves. "No. 28" was very irregular about water, and flooding the cylinders was a common occurrence, and when water had gone over at the first down grade, the oiling and reversing was gone through with, or else the throttle got caught.

I think this is one reason why valves wear faster on locomotives than on stationary engines. The water from the boiler is more apt to get thrown over into the steam pipe, and from the heavy draft of steam at times it must be very wet, all of which tends to wash off the oil, and while it may not scratch the surfaces, the wear will be greater for it.

A stationary engine supplied with steam from a boiler that gives wet steam will require more oil and more repairs to steam surfaces. An engine with uncovered steam pipe will also require more oil and repairs than with one covered.

D. W. S., in May 2 issue, also bears evidence to the lubricating properties of water, as he runs a steam machine without oil.

Forty years ago there was a prominent engine builder in Springfield, Mass., that used to build engines without any means whatever of oiling the cylinder, and some of those engines are running to-day with perfectly bright and smooth steam surfaces. These were slide valve engines with throttling governors. Whether the owners of the engines have saved enough on oil to pay for the coal necessary to overcome the excessive friction, is a question that will never be settled.



THE "GEM" FOOT LATHE.

An engine with poppet or slide valve will run without oil; an engine with automatic disengaging motion, when steam follows as late as one-quarter stroke, so that sufficient steam is admitted to the cylinder to balance the valve, will also work satisfactorily to some people without oil, but one that cuts off at one-eighth or less part of the time, whether slide, rolling or any similar valves, will not work without oil, because of the great pressure of steam and excessive friction, unless a sufficient quantity of good oil be used. There are some cylinder oils that are no better than water, and some that are worse. In all cases the parties operating the engine must pay for the oil or coal, and, this being a free country, they can take their choice.

There appears to be a varied experience with expansion joints. There is one 10" diameter on our premises, in a pipe 200 feet long. It is an ordinary slip joint, and the travel is over 3 inches. It is packed once a year with square rubber-back packing, with black lead put on the surfaces that wear. Except when packing, it gives no trouble and requires no attention. We have another joint made from the same pattern, and fitted up with equal care in a pipe 85 feet long, that requires to be repacked once in two or three months, and then is never tight. It has also been difficult to hold the pipe together, one stay rod shearing off a ¾" bolt; and yet this joint has not given me as much trouble as a flange or cymbal joint in an 8" pipe did one of my neighbors.

These two expansion joints are similar to two different men's experience in oiling cylinders. Under apparently similar conditions the results are widely different.

W. E. CRANE.

Hints About Files.

Editor American Machinist:

A dozen files is more than I ever cut, though probably I can do a better job of filing than the average file cutter, having two arms, ten fingers, and two times ten years' experience with files. I have seen files cut on a machine in Pennsylvania, and cut by hand in Illinois, and have played base-ball with a file cutter.

Sometimes a file will not behave as it should, but will chatter. Some men who have used files may suppose that to change the direction of the file will obliterate the chatter marks, or if it will not, then try another file. We cannot always change the direction of the file, and we would rather not be obliged to try another.

I have often thought that a file would be less liable to chatter if it was cut with a gradual change of pitch, somewhat finer at the forward end.

Another idea on files: Make a flat or a hand file bastard on one side and second cut on the other side. This would be a desirable file to take along with you on an outside job, or for a man to use who wanted a little of both, or for him who does not know what he wants. I think there is a field of usefulness for such a file.

J. E. MCCONNELL.

[Files cut by machinery with a gradual change of pitch have been on the market and very extensively used for years. They are called the "increment cut" files, the patent upon which is at the foundation of the business of Nicholson File Co.]

Restoring Steel—Reamers and Taps for Brass.

Editor American Machinist:

In issue of May 9th, J. M. R., of Trenton, N. J., inquires for a compound to restore burnt steel. While nothing will do this effectually, it may be improved very materially by re-heating and cooling in a solution proportioned thus: One gallon whale oil, two pounds rosin, two ounces black oxide of manganese; the whole to be hot and well stirred at time of using. Then work the steel as usual. Avoid letting steel cool in fire, but at time of withdrawal be sure the heat is rising or increasing; for, if the steel is decreasing in heat at time of removal, the results will not be satisfactory either for hardening, restoring or annealing.

Danger of burning small tools, such as are mentioned, is obviated by using a lead heating bath, and more even results are obtained by its use.

The best form for reamers and taps for brass may be found in those having the grooves or flutes cut spirally *left-handed;* this overcomes any tendency to chatter or draw in. It is recommended they be cut rather deeper and finer than for iron, presenting more cutting surfaces, and having plenty of clearance for chips; but do not "back off" more than necessary.

Dies should be well muzzled and cleared, allowing no more than is necessary to steady them to bear on work.

Squealing is evidence the tool is not correct, or the manner in which it is applied. However, it will occur at times, consequent on an exceedingly small deviation from perfection, or trifling dullness. It is very seldom heard where good oil is used, which it certainly should be, as well as on harder metals, although popularly deemed unnecessary.

H. E. W.

A Synopsis of Papers and Discussions at the Erie Meeting of the Mechanical Engineers.

Thomas S. Crane presented a paper on "The Piping of Steel Ingots." He showed the defect in steel ingots as ordinarily made—that is, the presence of what is technically known as a pipe at one end of the ingot. No subsequent working of the ingot served to unite the walls of this pipe, as they became quickly oxidized by exposure to the air, and no amount of re-heating would make them weld thoroughly. Every bar formed from such an ingot, therefore, had a defect at one end, and it was common to remove this defect by breaking off the bar in sections until sound metal was found; but inspection could not always prevent steel with this defect from passing into the market, and the defective part might, in subsequent working, find its position in a tap, reamer or other tool. A remedy for this defect had been sought in the use of powdered charcoal on top of the ingot when poured, but the effect in preventing oxidation was slight. The compression process of Whitworth had never been wholly successful; it operated to consolidate the exterior of the casting without permitting the free discharge of gas, and while it operated to prevent piping, it was liable to produce a spongy or porous casting. Other cases of the application of pressure were noted, up to 60,000 pounds per square inch, but a defect still remained in ingots thus treated.

The author then described a device made by the Solid Ingot Company, of Jersey City, N. J., by the use of which the ingots are cast in successive moulds, made without bottoms, and superposed one upon another, and successively filled, the shrinkage in each ingot being fed by the fluid metal in that above it. "the resulting product being a series of absolutely sound ingots connected by cold-shut joints." By suitable machinery these moulds and the ingots were readily handled.

This paper, although an important one, did not, probably from the absence of steel men, provoke any discussion.

The paper presented by Charles H. Manning, on the "Comparative Cost of Steam and Water Power," published in full in our issue of May 16, brought out some discussion, but this discussion did not shake Mr. Manning in the position he took in the paper. Instances were cited, in which water power was far cheaper than steam, but these were irrelevant, because where this was shown to be true, coal was high in price.

Prof. Denton, however, made a point in calling attention to the fact that, previous to the presentation of this paper, there had been little bearing on the subject except vague statements. He was also skeptical as to the allowance of only $1\frac{3}{4}$ pounds of coal per horse-power for the compound engines used in New England cotton mills. He thought it should be two pounds. He did not think the water consumption was less than 16 pounds, and looked with distrust upon reports of more than eight pounds of water evaporated per pound of coal, including banking fires.

Mr. Sheffler called attention to a misprint in the paper brought about by the transposition of numerals. This occurs in the table in 4th column, page 3, of the AMERICAN MACHINIST of May 16. Against the line "Compound Engine, one-quarter exhaust used for heater, etc.", the reading should be 12.16 instead of 21.16.

In reply to criticisms, the author stated that his figures were from actual practice in New England mills. A properly designed boiler would evaporate more than ten pounds of water from feed of 120° into steam of 100 pounds or over.

In discussing James W. See's paper on "Standards," a synopsis of which we gave in our May 16 issue, Oberlin Smith heartily approved of the efforts of the author. In their shop they had tried to begin reformation in this respect, but the success was not entirely flattering. He thought the work should be done once for all by a syndicate, and not be left for individual suggestion and action. A committee should be appointed to do the work.

Amongst other things in the multitude of confusion, he instanced the fact that it was now proposed to have another wire gauge. Wire, and many other things, should be gauged by thousandths of an inch.

Mr. Suplee said that, in the direction of standards, the convention of builders had adopted a standard size of brick.

Prof. Wood wished to add to the long list of Mr. See, government postal business. He thought government, for the sake of bringing about uniformity in sizes, should sell stamped envelopes of certain fixed sizes for the price of the stamps.

It was the general expression that, in making the list of things that it was desirable to standardize, Mr. See had done an important work, and one involving a great deal of labor.

On motion, a committee was appointed to act upon the suggestions contained in Mr. See's paper.

Professor Webb presented a paper entitled "Note on the Steam Turbine," the greater part of which appeared in our issue of May 16. The professor had discovered a steam turbine, used for electric lighting on a steamship which he believed was considered, as a steam engine, quite efficient. The steam acted against peculiarly shaped wings, and was finally discharged into the atmosphere at a very low pressure—possibly not more than one pound above the atmosphere. Just exactly what useful work it had done in expanding was not made quite clear. But the speed of the turbine was kept low, from which it was assumed there was a gain, although just where this gain came in was not easily seen.

In discussing this paper Mr. Swasey said that he had noted the revolutions of a steam turbine made at Cleveland, and found it running at a speed of 25,000 revolutions per minute. In this turbine there were successive expansions into chambers gradually increasing in size, so as to bring the final pressure at discharge quite low. In this instance the speed was reduced by gearing—a one-inch pinion of vulcanized fiber gearing with a twelve-inch wheel of brass. He had not believed that gearing could be run at such a speed, but must trust his senses, which showed him this speed was attained. The shaft was $\frac{7}{16}$" diameter, and the largest revolving part about six inches.

Altogether the presentation of the steam turbine did not bring out any facts going to show that there was imminent danger of its superseding other forms of steam motors.

Professor Webb also presented another paper on "An Error in the Encyclopedia Britannica." This error which Prof. Webb thinks he has discovered, relates to the reaction of a jet issuing from a vessel. Prof. Webb courteously submitted his paper to Professor Unwin, who, it appears, holds himself responsible for the article in the Encyclopedia Britannica, and Prof. Unwin replied to it, his reply being presented in the discussion. As Prof. Unwin is at the disadvantage of not being able to personally argue his case, it is probably best to let the matter go until it is settled by the more intimate contact of the parties in dispute. This appears to be no more than fair to Prof. Unwin. Prof. Webb handled his side of the question in a way to indicate that he was amply able to take care of himself.

Samuel Webber presented a paper on friction in transmitting dynamometers—the paper going to show that there was no irregularity of moment in the operation of the machine.

In the discussion of this paper Prof. Denton put himself on record by asserting that the much-abused Morin's investigations in regard to friction, considered in a practical sense, were substantially correct. Morin's laws, deduced from his experiments, have been much disputed of late, and the fact that Prof. Denton's experiments, under ordinary conditions, confirm them, is important.

Prof. Denton presented a paper on "Steam Consumption of Engines at Various Speeds." In this paper the superiority of increased speed within reasonable limits is shown; also the advantage of high boiler pressure. A very distinct loss from throttling is shown, but there is a gain by carrying high boiler pressure and throttling down for a low mean effective pressure, as against carrying just sufficient pressure to do the work without much throttling. In some tests throttling appears to have resulted in superheating to the extent of preventing condensation in the cylinder.

Mr. Towne presented a paper on "Gain Sharing," which was taken as showing the results in the large establishment of which he is vice-president. The paper advocates sharing the gains of a manufacturing or other establishment with the workmen, and set forth a plan of doing so. It was the generally expressed opinion that there were difficulties in the way of carrying the plan into execution, which would be evolved after an extended application.

In discussing the paper by Prof. De Volson Wood, on "Expansion of Timber, due to the Absorption of Water," the conclusions of which appeared in our issue of May 16, Mr. Ball said in their pattern shop they were making an engine frame, the construction of which he showed by a sketch. It was made, of course, of different pieces, presumably alike, but one of the pieces shrunk lengthwise, about one-eighth of an inch in three feet. This was thought very remarkable by the pattern maker.

The conclusion appeared to be that there might be considerable shrinkage of timber lengthwise.

Notes of the Mechanical Engineers' Meeting at Erie.

During the stay at Erie the members visited the water-works of the city. The pumping is done by a duplex compound Gaskill pumping engine, cylinders 21" and 42" by 36" stroke. The requirements of the city are about five million gallons daily, pumped against a pressure of 90 lbs. To do this work the expenses for coal are only $2,500 per year. The coal used is soft slack, costing at the pumping station a little more than one dollar per ton. The boilers are horizontal tubular; there are four of them, in two batteries, one battery only being used at a time. There are also, held in reserve, a pair of Cornish engines. It is said that the Gaskill engines show an economy of from forty to fifty per cent. as compared with the Cornish engines.

Mayor Clark, in his address of welcome to the mechanical engineers, paid a merited tribute to local mechanical genius, which had done so much to make Erie a prosperous city. The study of the theory of mechanics, he said, well repaid the effort, even when the knowledge obtained was not put to practical use; but when so used it became a benefit to mankind.

On one afternoon a visit was made to the Erie City Iron Works, the Stearns Manufacturing Company and the Jarecki M'f'g Company. At the Erie City Iron Works the shops are not new, but are arranged for the manufacture of boilers and engines in large quantities. About one boiler per hour is made.

At the Stearns M'f'g. Co's. the new shops were inspected, and were admitted to be excellent examples of shopitecture. The machine shop is 81x300 feet, having a clear center space, covered by a traveling crane, and two "galleries." Under the galleries the space is devoted to machine tools, and to assembling machines. In the central space heavy machinery is assembled. The galleries over the main floor are devoted to smaller machine tools, and to light floor and bench work. At the end of one of the galleries the drafting room is located—very well in reference to light and general convenience.

The visiting members were particularly interested in the drafting room appliances, especially in the printing arrangements, spending a good deal of time in investigation. The general equipment of the drafting room were commended, while the special equipments were considered perfect.

In the machine shop the central part of the building is extended above the traveling crane, so as to give room for windows for light and ventilation.

Beyond the machine shop the boiler shop and smith shop extends, so as to make a total length of 647 feet.

The foundry extends parallel with the machine shop, a railroad track separating them, upon which cars connect with the various railroads, affording excellent opportunities for getting supplies and for shipping machinery.

The foundry is 95 by 200 feet, covered by a traveling crane, and further by some ten or twelve post cranes. This makes the handling facilities of the foundry equal to those of any foundry in the country working on a similar class of work. A railroad track connects the foundry and machine shop.

The shops noted, and the others devoted to storing machinery, shipping, etc., etc., comprise a very complete and efficient plant, and one that shows a great deal of attention to the design.

At the Jarecki Manufacturing Company's works all kinds of steam, gas and water fittings are made. Special machines are used for nearly all the work done, some of them working semi-automatically, and in a way that shows much ingenuity in the way of invention. In one machine noticed at work, the bodies of twelve plug cocks were being bored, tapering, at the same time, without much attention from the attendant.

At the Ball Engine Works there were seen tools well adapted to the work of building high-class automatic engines.

In the testing room every engine is tested before going out. Friction brakes are applied, which automatically govern the load to be applied in testing.

The Erie Engine Works were visited, as well as various other establishments, and the members left Erie, duly impressed with its importance as a manufacturing center.

The committee of the American Society of Mechanical Engineers acting in relation to the visit to England has issued a final circular to the members. From this we learn that one hundred and seventy mechanical and mining engineers will sail on the "City of Richmond," and one hundred mechanical and civil engineers on the "City of New York." On the evening of June 6 a formal reception will be tendered the united parties by their English hosts, in Liverpool. Invitations to visit many important works have been received, and every effort is being made by English engineers to make the stay of their visitors pleasant and profitable.

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Scale in Boilers.

One effect of faith in the various nostrums that are guaranteed to prevent scale in boilers is to beget carelessness, under the assumption that the use of the specific will make everything safe. Some of these preparations may be excellent in their way, but none of them are universal in their application, any more than one drug is a cure for all diseases. And it is possible that what would be found just right with one kind of water, would do serious damage with water containing a different class of impurities. We are not arguing against the use of boiler purgers, but if they are used it should be with judgment, and a knowledge of the fact of whether or not their use would prove—under the circumstances—harmful.

Again, it should be borne in mind that preventing the formation of scale is not all that is required. If the scale-making matter is prevented from adhering to the metallic surfaces of the boiler, it is nevertheless present in the boiler, and must be got rid of, or it will do serious damage. It would seem unnecessary to refer to this; but a little conversation on the subject with those who spend their time inspecting boilers will convince the most skeptical that more attention to this subject would save considerable trouble.

With some kinds of water it is doubtful if anything so far known, mixed with the water, will prevent scale on some parts of a boiler, although much will depend upon the construction of the boiler. Good judgment, therefore, would, in cases where it is difficult or impossible to entirely prevent the formation of scale, lead either to the use of a type of boiler that can easily be come at in all its interior parts for removing the scale, or one so constructed that the circulation of water prevents scale formation in parts where it would be dangerous, and with good provisions for removing the greater part of the scale-making material from quiet parts of the boiler, while it is in the condition of dirt.

If the scale-making impurities are removed from the water either before or after it enters the boiler, then of course no scale will be formed, and this appears to be a sensible thing to do. In fact, it appears to be right to put the matter, in point of importance, about as follows: First, when practicable, remove the scale-making matter from the water; if impracticable to do this, then use whatever is best under the circumstances to assist in the prevention of scale, with a full understanding of the fact that the foreign matter must be got rid of; in cases where water is particularly bad, use a type of boiler from which it will be convenient to remove scale, or in which the circulation of water will be such that the scale-making matter can be removed as dirt.

In regard to the deterrent effect of scale on steam making, it is almost needless to say that very few believe in the formulas given covering this point. Like many another thing, this has been enormously overrated. But when it is considered that it is impracticable to use fire sheets of more than three-eighths of an inch in thickness, for the reason that they will burn down to that thickness, it will be understood that, outside any question of economy, scale over fire surfaces is an important element of danger.

Second-hand Machinery.

There are many lines or classes of goods in which second-hand articles may often be obtained, that are, to all intents and purposes, fully as good as new articles of the same kind; the simple fact of their having been used, largely depreciating their market value, though not injuring them in the least nor lessening their actual value for the purpose for which they were intended.

Many articles of value are sold by their original owners at a price far below their real value, on account of some mere whim, or because perhaps not quite the thing required by the most recently promulgated decree of fashion.

But it should constantly be borne in mind that, in the case of machinery, the question of second-hand goods is a different matter entirely. Machinery is not usually bought or sold on account of whims, nor at the dictates of fashion. A man buying a machine of any kind usually buys it for a definite purpose, that purpose being to make money; and, except in very rare cases, the machine is not disposed of as second-hand until its power to make money has well nigh if not totally disappeared. With most machinery, deterioration begins with its use, and proceeds in an increasing ratio, until finally a point is reached where the necessary expense of maintenance cannot profitably be borne. Many firms clearly recognize this fact, and when that stage arrives promptly dispose of old machinery and put in new, knowing that there will usually be some one ready to pay them more for the old machinery than it is worth to them or any one else.

Not only does machinery lose its value by wear, but often its value is much more rapidly depreciated by improvements in machinery of the same class, and it may thus happen, and, in fact, often does occur, that a machine, almost new and not worn to an appreciable extent, is yet suddenly rendered almost worthless by some new invention or improvement with which the old machine cannot compete.

Of course there are cases where second-hand machinery may be bought and used to advantage, but we think they are comparatively rare; for, usually the same reasons which have led to the sale of a machine, after being in use, are good and sufficient reasons for not setting it up in another shop and attempting to make money with it.

In case of a failure of a new concern, where the machinery is of the latest design, and unworn, bargains are sometimes to be obtained, but such opportunities are very rare indeed; for it is usually the old concern, with machinery out of date, and rendered almost worthless by the competition of improved machinery, which goes to the wall. There are, of course, other circumstances under which the purchase of second-hand machinery may be advantageous, but in the vast majority of cases where it is purchased and put into use it is found that new machinery would have paid far better.

An inspection of the stock of most dealers in second-hand machinery will show to the practiced observer that most of the machinery is of the kind which it is very questionable economy to buy even when new, and that, moreover, it is of the class which most rapidly loses by use what little original value it may have had. Of course this is not saying that there are not dealers in second-hand machinery who do a strictly legitimate business, and who sell such machinery for just what it really is; for there are such dealers. But even where there are the best intentions there seems to be a natural inclination to over-estimate values, and it is a familiar fact that it is nearly always much easier to get the full value of a second-hand machine than of a new one.

As we have said above, there are conditions under which the purchase of second-hand machinery may pay, but they are unusual conditions, the usual being such as to make it far better to buy new, and the latest improved machines.

"An Engineer's Examination."

In our issue of May 2 we published an editorial under the above heading, the subject being suggested, as was stated, by a conversation with an engineer. The *Marine Journal*, of May 11, reprinted this, prefacing it as follows:

We print the following leading editorial from the AMERICAN MACHINIST of May 2. The license in question was raised since Geo. H. Starbuck, United States supervising inspector, has been acting boiler inspector at this port, and the only one in authority to sign such license. Comment is unnecessary.

We object to the above, in the first place because it puts, by implication, an interpretation upon what we wrote that is not borne out by the text. We did not criticise the act of any inspector; so far as we know they all do their work well in the way that custom prescribes. What we did suggest was that the examinations should be more complete in some specific directions, or that examination in these directions should be dispensed with.

In the second place, we object to the above because it contains a positive misstatement. The conversation with the engineer, to which we referred, occurred before Geo. H. Starbuck began acting as boiler inspector, hence he had nothing to do with raising the license in question. With these two trifling exceptions we have no objections to our contemporary's prelude.

An exchange says: "Ohio has 4,000,000 people, with $14,000,000 in savings banks. Maine has 660,000 people, with $41,000,000 in savings banks! Ohio has $3.33 to each individual, Maine has $62 to each individual, in savings banks." According to the arguments often put forth, this ought to demonstrate that the working people of Maine are about eighteen times as well off as the working people of Ohio; only we know that such is by no means the case. What it does prove is, simply that savings bank deposits are no indication whatever of the relative prosperity of working people, either as between different localities or different times.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(223) A. T., Olney, Ill., writes: I am running an engine in a large flour mill, and have in charge two boilers 18 feet long, 48 inches diameter. About four years ago they were burnt, and had to be patched. Examining them recently, I find that there are several cracks running from the rivet heads to the edge of the patch, which is also badly corroded; I think that the corrosion extends half way through the sheet. What I want to know is this: Will it go off suddenly, or will leaks appear first, so as to give warning? *A.*—We earnestly advise you to have the boiler repaired at once, as it may blow up suddenly; timely warning must not be depended upon.

(224) J. H., Buffalo City, Wis., writes: I wish to build a high-speed fly-wheel pump of the steam fire engine style; steam cylinder, 7⅝x8 inches; pump, 4⅝x8 inches. I wish to ascertain the size of steam and exhaust ports; lap of valve; also amount of inside lap if any is required. *A.*—Assuming that the highest piston speed is to be 200 feet per minute, the area of the steam port is found by multiplying the cross-sectional area of the cylinder by .033; the product will be the area of the steam port; thus the area in square inches of a cylinder 7⅝ inches in diameter is 45.66; and $45.66 \times .033 = 1.50+$ square inches, which is the area of the steam port. The ratio between the width and length of the steam port is to some extent arbitrary; the general custom is to make it as long as the design of the engine will admit. In small engines, provision must also be made for insuring good castings; in the case before us, a width of ¾ of an inch for the steam port will probably be the smallest for insuring a good casting; hence, adopting a port ¾ of an inch wide, the length of the port will be $1\frac{1}{2} + \frac{3}{4} = 4$ inches. If the bridges are ½ inch wide, an exhaust port $\frac{5}{8} \times 4$ will be sufficient; if the bridges are less, make the exhaust port $\frac{3}{4} \times 4$ inches. In our issue of Sept. 5, 1885, you will find the principles upon which our remarks are based. Outside lap 3-16 of an inch; inside lap, about 1-32 of an inch.

(225) X. Y., Delft, Holland, writes: Please tell me in what manner circular saws are ground to equal thickness or taper, and such a fine surface. I use several tapered circular saws 32 to 48 inches diameter, and 5-32 thick. After the saws have been worn down to a certain amount, they become too thick. In such cases we true them up and turn them to a taper and proper thickness by hand, and with a triangular tool. This takes too much time, and does not always give the best results. I propose to use, instead of turning, an emery wheel 12 inches diameter, 1 inch thick, making 1,200 revolutions per minute, and moving to and from the periphery to the center of saw, which will make 4 revolutions per minute, and the time for the emery wheel to travel from the center to the periphery will be about one hour. The few experiments I have made indicate that this process will require too much time to grind the saw to the required taper, and may not give satisfactory results. *A.*—We are not aware of the use of emery wheels for grinding the taper on circular saws. Circular saws are ground in machines specially built for the purpose. A machine of this kind is provided with two large grindstones which have at the periphery a speed of about 2,500 to 3,000 feet per minute. The stones are brought

together by a screw. The saw is placed on a temporary arm attached to a carriage which has a traversing motion, and passes the saw between the grindstones. In the meantime, the saw is made to revolve, thereby exposing all parts of its surfaces to the action of the stones. After the saw has been ground in this manner to the required thickness, it is placed on a face plate, which gives the saw a rotary motion, and then blocks of lead, cork and leather supplied with emery and oil are in succession pressed against it, giving the fine polish and also the appearance of having been ground circularly.

(226) A. L. F., Chicago, Ill., writes: In answer to two correspondents, in your issue of April 4, you stated that the air pump capacity of a compound engine should be ⅛ to 1-9 the capacity of the low-pressure cylinder. I would like to know your reason for giving these proportions. Also, should not the size of pump be given relatively to the high-pressure cylinder, as the steam must necessarily pass through that first. I know of three compound engines having an air pump capacity respectively of 1-11, 1-13, and one 1-17 of that of the low-pressure cylinder, and the last works as well as either of the others. I think that if the proper arrangements are made for bringing the steam and water together, that the condenser can be made much smaller than the proportions you give. The condenser of one of the above engines is between one-eighth and one-seventh of the capacity of the low-pressure cylinder. *A.*—In Question 151, it will be noticed that the given engine has a jet condenser; for this class of condenser a larger air pump is required than for a surface condenser. The air pump capacity also depends on the rate of expansion, and since the given steam pressure is comparatively high, we concluded that the rate of expansion in so small an engine will be low, and therefore we believe that the air pump capacity given in our answer is correct. But we do not wish to be understood that all air pumps must have the capacity given for that particular engine; the rate of expansion will, to a great extent, determine the capacity of the air pump, as the following table will show. This table gives the ratio of capacity of cylinder or cylinders to that of air pump; in case of the compound engine, the low-pressure cylinder capacity only is taken, and not the capacity of the high-pressure cylinder.

Description of Pump.	*Description of Engine.*	*Ratio.*
Single acting vertical	Jet condensing, expansion, 1½ to 2	6 to 8
" "	Surface condensing, expansion, 1½ to 2	8 to 10
" "	Jet " 3 to 5	10 to 12
" "	Surface " 3 to 5	12 to 15
" "	" compound, 3 to 5	15 to 18
Double acting horizontal	Jet condensing, expansion, 1½ to 2	10 to 13
" "	Surface condensing, expansion, 1½ to 2	13 to 16
" "	Jet " 3 to 5	16 to 19
" "	Surface " 3 to 5	19 to 24
" "	" compound, 3 to 5	24 to 28

Even with the aid of the foregoing table, considerable good judgment and experience is required to determine the capacity of the air pump. In Question 157, the given engine has a surface condenser, but the steam pressure is high, and the cut-off late, and therefore giving comparatively a low rate of expansion; under these conditions, and particularly for so small an engine, we believe that the air pump capacity given in the answer is correct. As for the condenser capacity, it may be said that the objection to a large condenser, beyond its cost and weight, is that a longer time is necessary to form a good vacuum in it; and the objection to a small condenser is its liability to flooding. It is said that Mr. Watt made the condenser capacity equal to ⅓ that of the cylinder; in some of the modern stationary engines we find a still smaller condenser capacity, but in such cases the rate of expansion is very high, and the general design of engine is such as to prevent overflowing to the cylinders by flooding the condenser. In marine engines there is an objection to jet condensers of so small capacities, on account of the irregularity of the motion, caused by the roughness of the sea, in consequence of which the air pump at times moves only slowly, though the injection water is all the time running in at its accustomed speed. The water may therefore accumulate in the condenser, and may run back into the cylinder, thereby causing damage. Consequently, in marine engines, the capacity of the jet condenser is seldom less than one-fourth that of the cylinder or cylinders exhausting into it, and need not be more than one-half of it, unless the engine is a very quick running one; one-third the capacity is generally sufficient.

(227) E. S., Chicago, Ill., asks: What kind of steel will be the most rigid for a rod ¾ inch diameter and 3 feet long, freely supported at the ends, and having a weight of 60 pounds suspended from its center? Would tool steel do, or is there anything better? *A.*—If simply rigidity is required, and the load be gradually applied, tool steel will probably give the best results. If the weight is suddenly applied, then spring steel will probably be the best kind to use. 2. Suppose we have weights suspended as shown by the enclosed sketch. (Fig. 1 represents a fixed pulley with a rope passed over it; a weight is suspended from one end of the rope, and the power applied to the other end. Fig. 2 represents a fixed pulley and a loose pulley; the rope is passed over the fixed pulley, round the loose pulley, and its end fastened overhead; the power is applied to the other end of the rope, and weight suspended from the loose pulley. Fig. 3 represents two fixed pulleys, and one loose pulley. The rope is first passed over one of the fixed pulleys, then round the loose pulley, and finally round the other fixed one; one end of the rope is fastened to the sheath of the loose pulley, from which the weight is suspended; the power is applied to the other end of the rope. In each case the weight is such as will require a force of 5 pounds to hoist it.) The question is: In which case will the applied force travel the quickest? *A.*—The applied force shown in Fig. 3 will travel the fastest. If we consider the arrangement of the rope in Fig. 3, and leave the friction out of consideration, we will perceive that the weight will descend one-third as fast as the applied force will move in a given direction, because in Fig. 3 three parts or cords support the weight. If, for instance, the weight descends 1 foot, each cord will be lengthened 1 foot, making a total of three feet of rope which is taken up; hence, the applied force will travel 3 feet during the time the weight descends 1 foot. By similar reasoning, we conclude that the applied force in Fig. 2 will travel twice as fast as the weight will descend; and in Fig. 1 the velocity of the applied force and the weight will be equal. Since we may assume that all the weights will descend through a given distance in the same time, it follows that the velocity of the applied force in Fig. 3 will be three times greater than that of the applied force in Fig. 1. 3. Would a cylinder with piston arranged for a vacuum be better than the weights? *A.*—That will depend on the purpose for which you intend to use the arrangement.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue

Gear wheels and g-cutting. Grant, see adv., p. 16.
Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.
$100 Reward, page 14.
$100 Reward, page 14.
$100 Reward, page 14.
Shafting Straighteners. J. H. Wells, Tampa, Fla.
Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.
20" Upright Drills. J. E Snyder, Worcester, Mass.
23" Upright Drills. J. E. Snyder, Worcester, Mass.
25" Upright Drills. J. E. Snyder, Worcester, Mass.
28" Upright Drills. J. E. Snyder, Worcester, Mass.
"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.
The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.
R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.
The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.
S. W. Card & Co., Mansfield, Mass., carry a full line of Stay Bolt and Patch Bolt Taps.
Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.
Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.
Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.
Best silk wiping towels for machinery in the market. S. A. Smith, 23 S. Canal st., Chicago, Ill.
Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.
Iron Planers from 16" to 36" wide by any length. H. C. Pease & Co., Worcester, Mass.
Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See May 9, p. 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.
The best Emery Wheel made is the "Norwich." For particulars send to Montgomery & Co., 105 Fulton st., New York.
For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.
For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.
For Portable Key-seating Machines and Stub Ends for small connections, address T. C. Dill Machine Co., 726 Girard ave., Philadelphia, Pa.
Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.
W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.
Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.
Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2.00. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.
Patterson, Jordan & Gottfried, 146-150 Centre st., N. Y. Metals, Machinery, Hardware, Tools and Supplies for Machinists, Mills, Engineers, Brass Goods Mfrs., Factories, etc. An extensive assortment of Bolts, Screws, Wire, Taps, Drills, etc., carried in stock.
Patent or shop rights for sale, for perforating iron or steel plates for steam boilers, bridge work, iron or steel ship work, marine boiler heads, equal to drilled work and fifteen times quicker. Samples can be seen and circulars obtained from R. E. Dietz, 60 Laight St., New York.
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor place, New York.
"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.
"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including April 25, 1889 issue, 75 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.
"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 89 articles have thus far appeared up to and including the April 18, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

Elmer Apperson is erecting a machine shop at Kokomo, Ind.

Stacy, Lykens & Co. will build a saw and grist mill at Caney, Ky.

The question of water-works is being considered at Hendersonville, N. C.

At Lockport, N. Y., the Lockport Pulp Co. will erect a 20-ton wood pulp mill.

Jno. E. Randle & Co. are building an addition to their machine shop at Memphis, Tenn.

The town authorities at Collierville, Tenn., are considering the question of water-works.

At Florence, Ala., the Lauderdale Mfg. Co. are interested in a proposed new cotton mill.

Extensive improvements are contemplated by the Birmingham (Ala.) Foundry and Machine Co.

The Elizabeth, Lexington & Big Sandy Railroad Co. will erect machine shops at Lexington, Ky.

A large power plant will be erected at St. Louis by the Electrical Accumulation and Power Co.

At Mystic, Conn., the Standard Machine Co. has contracted for a large addition to their buildings.

The Union Drawn Steel Co., of Beaver Falls, Pa., has been incorporated, with a capital stock of $100,000.

The Richmond & Alleghany Railroad Co. are at work on new machine shops, roundhouse, etc., at Gladstone, Va.

A company called the Metcalfe Co. has been organized at Shippensburg, Pa., for the manufacture of machinery.

The works of the Armington & Sims Engine Co., at Providence, R. I., are to be increased by an extensive addition.

At Paris, Texas, a stock company is being organized to build a cotton mill. J. M. Fort is interested in the enterprise.

W. P. Rice, of Fort Payne, Ala., is interested in a 50,000-spindle cotton mill which is to be built at Denison, Texas.

A building for the construction of steel railway cars is being erected by the St. Joseph Steel Car Co. at St. Joseph, Mo.

The National Forge and Iron Co. has secured a track of land at East Chicago, Ind., on which they will erect a plant.

J. T. Wilder, of Roan Mountain, Tenn., has purchased a site for a foundry and machine shop at Blacksburg, S. C.

The Florida Central & Peninsular Railroad Co. will soon commence work on their machine shops at Fernandina, Fla.

At Grafton, W. Va., the Baltimore & Ohio Railroad Co. are erecting car and repair shop, where they will employ 200 men.

W. B. Snead & Co. have contracted to build new machine shops at Lynchburg, Va., for the Lynchburg & Durham Railroad Co.

Thirty-six car-loads of pipe are being turned out every twenty-four hours at the National Tube Works Company, at McKeesport, Pa.

Safety bicycles are to be manufactured by a company recently organized at Rochester, N. Y., called the Rochester Cycle Manufacturing Co.

The largest output for a single week of the Jones & Laughlin Steel Works, at Pittsburgh, occurred recently, when 2,350 tons were produced.

At Hattiesburg, Miss., the Meridian Sash & Blind Co. is building a saw mill of 50,000 feet capacity, and a planing mill of 30,000 feet capacity.

A new factory will soon be erected at Shelton, Conn., by the Excelsior Mfg. Co., makers of edge tools. It will be 40x280 feet, three stories high.

The Newport News & Mississippi Valley Railroad Co. have bought 1,600 acres of land at Clifton Forge, Va., and it is said will build large machine shops.

At Anniston, Ala., Carl Rednitz and Mr. Genert are considering the erection of a machine shop for the manufacture of their patent cotton seed oil mill.

Cramp & Sons have had made at the works of Carnegie, Phipps & Co., some 24-inch beams to be used in the construction of one of the Government's new cruisers.

Repair shops and roundhouses will be erected near Grantville, Conn., by the Poughkeepsie Bridge Company, 400 acres of land having been secured for the purpose.

A company, to be known as the Galveston Cotton and Woolen Mills, has been organized at Galveston, Texas, with $500,000 capital. Work will soon be commenced upon a new mill.

At Allentown, Pa., the Iowa Barb Wire Works will erect a plant to make their own rods from American steel billets. The rods have been heretofore imported from Germany.

Two and a half acres of land have been secured at Anniston, Ala., by J. & D. Noble, on which they will erect an addition to their plant, the building and equipment of which will cost $10,000.

A rolling mill to cost $100,000, and to have a capacity of 50 to 75 tons of bar iron per day is to be established at Iron Gate, Va. It is expected that this will be followed by a nail factory and other enterprises.

The contract for building the engines, boilers and other machinery for the new naval vessel, the "Texas," has been awarded to the Richmond Locomotive & Machine Works, at $634,500. They will enlarge some.

S. R. Wilson, F. J. Smith, J. W. White and F. J. Wilson are the incorporators of a new company, recently organized at Chicago, called the Sampon Steam Forge Co. The business will be the manufacture of locomotive frames, and general forging.

The contract has been let for the construction of a new brick factory for the Overman Wheel Company at Chicopee Falls. The building will be 45x134 feet, four stories high. Considerable new machinery is expected to be put in before the opening of the next season.

The Bennington Woolen Mills, at Bennington, Vt., which have been shut down for three years, have been purchased by John S. Holden, of Palmer, Mass., who will put them into operation at once. It is said that the price paid is only eight per cent. of the original cost.

Some time since, in our "Shop Notes," we spoke of the crowded condition of the Hall Steam Pump Co's. works at Wilmington, Del., and of the contemplated addition to the plant. It is now announced that an addition 60x200 feet will be built this season, the plans having been already prepared.

At Roach's shipyard a new steamer has been laid down for the Old Colony Steamboat Company, which will be about the size of the "Pilgrim," her total length over all being 363 feet; she will, however, have more staterooms than that vessel, and will be used in winter as a companion to the steamer "Providence."

It is thought that a new wire rod mill will be in operation at New Castle, Pa., by the first of August, the foundation being nearly completed. About 150 tons of nail wire will be turned out every twenty-four hours. About 100 tons of the rods will be used by the New Castle Wire Nail Works, and the balance will be sold out of the city. Two hundred men will be employed.

Gould & Hedley have started in the machine business at 102 Morgan street, Jersey City. They will give special attention to repairing stationary engines and elevators, and to the erection of new machinery; they will also furnish estimates for all kinds of mill work, will do all kinds of repairs, and build special machinery. Both partners are practical mechanics of long experience.

The Knowles Loom Co., Worcester, Mass., will shortly commence the erection of extensive new buildings. The main building will be in the form of a hollow square, which on the four sides will be nearly 700 feet long. It will be four stories high, with a tower extending 50 feet above the main building. The total floor space will be 144,000 feet. Besides this, there will be a foundry one story high with a monitor roof, which will be 480 feet long, and a storehouse 35x104 feet.

The George Crompton heirs propose erecting a series of buildings on their land at Worcester, Mass., to accommodate those engaged in the manufacture of large machinists' tools and machinery. Plans have been prepared for a shop for the Powell Planer Co., which will be 125x100 feet. Through the center of these shops railroad tracks will be run, for the admission of cars and engines. The fixtures will be of the latest design for handling heavy work. The Wheelock Engine Co. are likely to become tenants of the Cromptons.—*Commercial Bulletin.*

Machinists' Supplies and Iron.

NEW YORK, May 18, 1889.

Iron—American Pig.—The market is really very much demoralized. The indications are that there is yet to be a struggle for supremacy, which will definitely settle which are the weak furnaces, and show just where iron can be produced the cheapest. Trade is secured on best terms, without much reference to quotations. New furnaces are being put in by the Thomas Iron Co. We quote No. 1 X Foundry, $17; No. 2, $16. These quotations are for Lehigh brands, Southern brands being quoted $1.00 lower. Grey Forge, $14.75 to $15.25.

Scotch Pig.—Coltness, $21.50 to $21.75; Gartsherrie, $20; Summerlee, $21 to $21.50; Eglinton, $19 to $19.25; Dalmellington, $19.75 to $20; Clyde, $20.50, and Langloan, $20.50.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Situation as foundry foreman; large experience. Good reference. Box 97, AM. MACHINIST.

Good machinist and tool-maker desires change about June 1. F. B., care AMERICAN MACHINIST.

A foundry superintendent wants situation or partnership. Address Box 101, AMERICAN MACHINIST.

Situation wanted by mech. draftsman; good ref. New York or vicinity pref'd. Box 102, AM. MACH.

Wanted—A responsible party in the city of New York to take the selling agency for a High-speed Engine. Address H. Speed, Esq., care AM. MACH.

Wanted—An American young man as tool maker; one familiar with the Hartford Automatic Screw machine preferred. Address M., AM. MACHINIST.

Wanted—Position as foreman by first-class machinist; at present holding same position; heavy work preferred. Address Reliable, AM. MACHINIST.

Draftsman, college education, journeyman machinist, inventor, experience, references, desires position. Address X, 48 Ridge st., N. Y.

Wanted—A man to temper dies, taps and reamers. Must be competent and understand the best methods of tempering steel. Address Box 94, AMERICAN MACHINIST.

Wanted—A first-class machinist with $5,000 to $10,000 cash in an old and well-established manufacturing business. Address P. O. Box 104, Baltimore, Md., giving reference, age and experience.

Wanted—By a machinist experienced as draftsman and designer, and successful in handling men, a position of responsibility, preferably as supt. or to travel. Address C. S., AMERICAN MACHINIST.

A young man with four years' experience on mill and agricultural machine work desires position in a good machine shop where he can work under instructions; engine works preferred; wages no object. Address B. K. T., care AMERICAN MACHINIST.

Manufacturer's assistant; similar situation wanted by middle aged man, well posted in different kinds of modern machines; good practical machinist, used to attend to workingmen, correspondence and bookkeeping. Reply to S. X. S., AM. MACHINIST.

Wanted—A thoroughly competent and energetic man, to take charge of about 100 men in the machine shop department of an agricultural implement factory in Western Canada; none but an expd. man need apply. Agricultural, AMERICAN MACHINIST.

Wanted—Foreman for machine shop in agricultural works; experienced in building portable and traction engines and general work, and capable of handling men on piece-work; state experience, age, and compensation expected. Address Box C, Schenectady, N. Y.

Wanted—A foreman to take charge of a small machine shop manufacturing special tools. To one fully competent, a good salary will be given or a permanent interest in the business. A young man preferred, and one who can give undoubted reference as to character and ability. Box 100, AM. MACH.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, O.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, O.

Steel Name Stamps, Copper Burning Brands, etc. W. G. Sackmann, 1099 First av., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Room and power to rent to suit any capacity, large or small. Inquire of Hartford, Conn., Board of Trade.

To Lock and Hardware Mfrs.—Pat. 403,393, May 14, for sale; send 20c. for copy. H. Stanynought, 278 Comstock st., New Brunswick, N. J.

Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Wanted—100 or more machinists or amateurs to send for model engine castings; complete in sets; send for circular. Lowell Model Co., 170 Merrimack Street, Lowell, Mass.

Established 1832. BRADLEY'S POWER HAMMERS
The BEST in the WORLD
RUN BY BELT.
Over 1500 in USE
BRADLEY'S HELVE HAMMER. BRADLEY'S UPRIGHT HAMMER. BRADLEY'S UPRIGHT HAMMER.
BRADLEY'S HEATING FORGES
BRADLEY'S HAND COAL HEATING FORGE. BRADLEY'S SOFT COAL FORGE.
Indispensable in all shops to keep BRADLEY'S CUSHIONED HAMMERS and men fully employed and reduce the cost of production.
BRADLEY & CO. SYRACUSE, N.Y.
63 Murray st. NEW YORK; 98 Sudbury st. BOSTON, MASS.

SOLID EMERY OIL STONES AND Triple Coated KNIFE SHARPENER
WHOLESALE ONLY BY THE TANITE CO., STROUDSBURG, PA.

$75
"Star" Foot Lathe Swings 9x25 in.
LA LATHE
Screw Cutting Automatic Cross Feed, etc.
Scroll Saws, Circular Saws, Lathes Mortisers.
Catalogue Free of all our Machinery.
Seneca Falls Mfg. Co. 687 Water St., Seneca Falls, N.Y.

MACHINIST'S SCALES,
PATENT END GRADUATION.
We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
COFFIN & LEIGHTON, SYRACUSE, N. Y.

SEND FOR CATALOGUE.
WORCESTER MACHINE SCREW CO.
WORCESTER, MASS.
Manufacturers of Set, Cap & Machine Screws, Studs, etc.

A Manual of Steam Boilers, their Design, Construction, and Operation. For Technical Schools and Engineers. By Prof. R. H. Thurston. Many illustrations. 8vo, cloth. $6.00.
"Probably one of the most complete works on Steam Boilers that has ever been issued."—*Manufacturers' Record.*
JOHN WILEY & SONS, New York,
PUBLISHERS OF SCIENTIFIC AND INDUSTRIAL WORKS.
. Catalogues Supplied gratis and free by Mail to order.

MACHINERY
For Reducing and Pointing Wire.
ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information, address the Manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

DRILL PRESSES.
BICYCLES.
STERLING ELLIOTT
Newton, Mass.
TAP DRILL GAUGES.
CUTTING-OFF MACHINES.

FOR SALE.
A Valuable Plant of Machinery, consisting of
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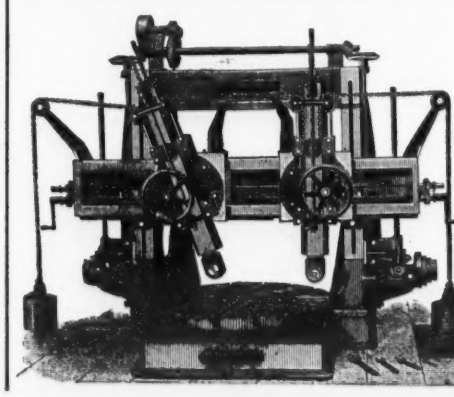

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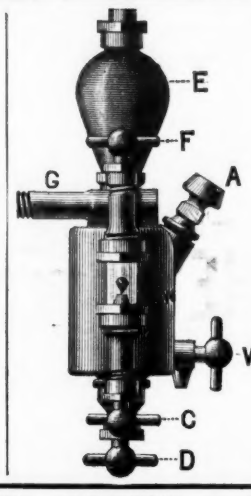

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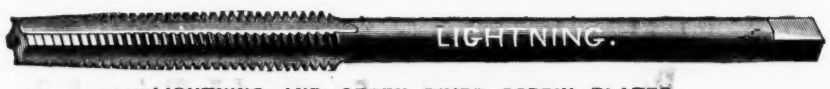

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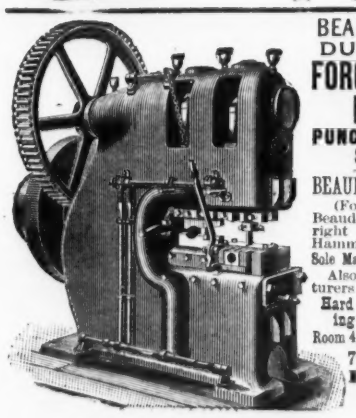

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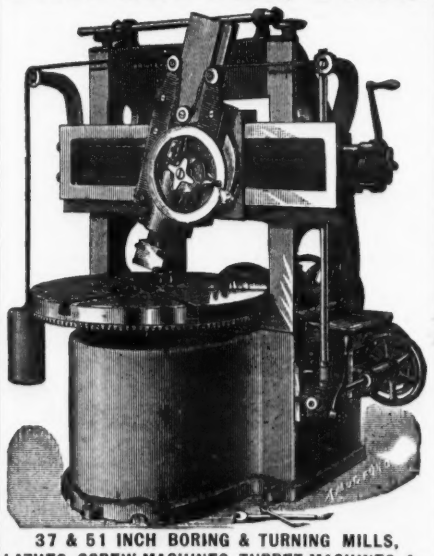

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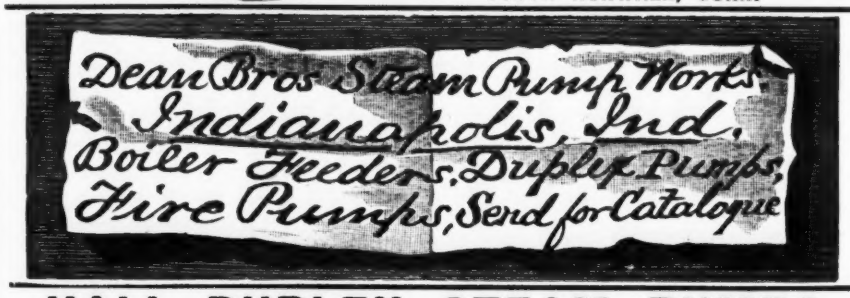

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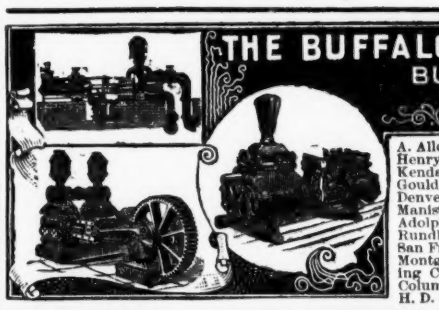

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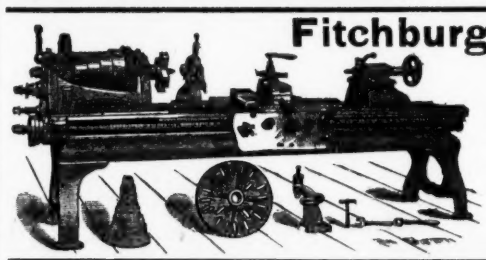

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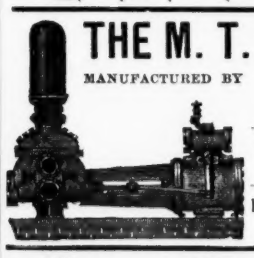

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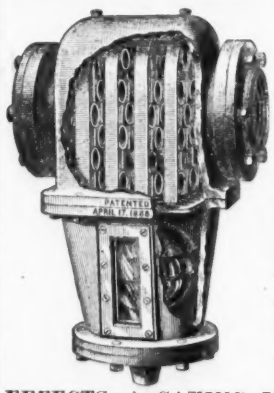

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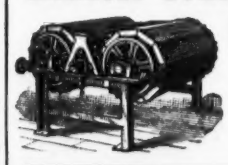

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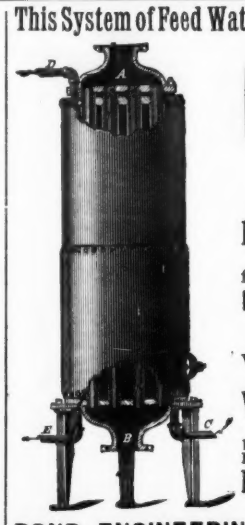

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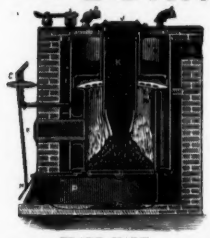

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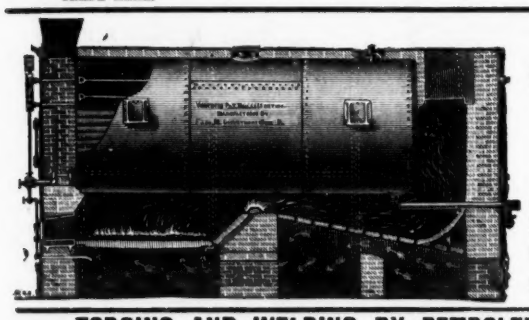

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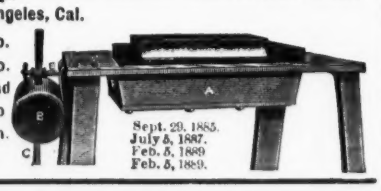

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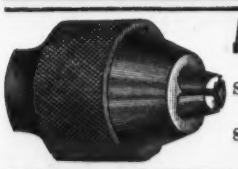

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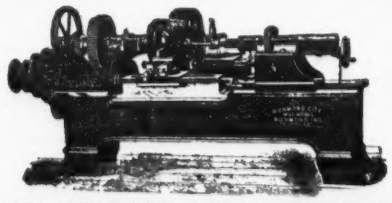

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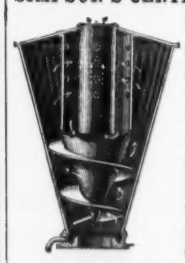

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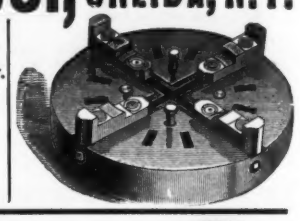

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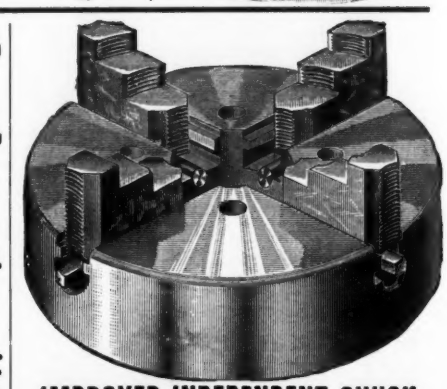

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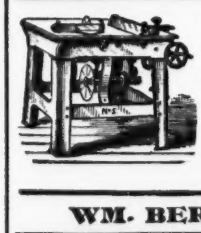

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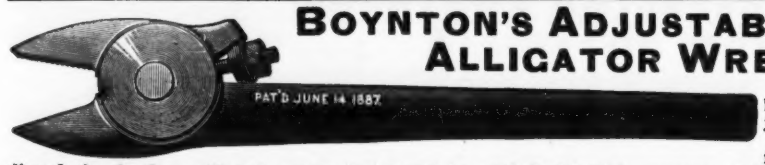

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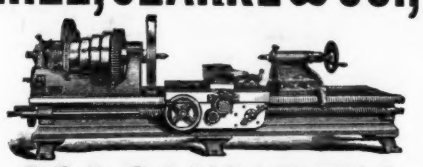

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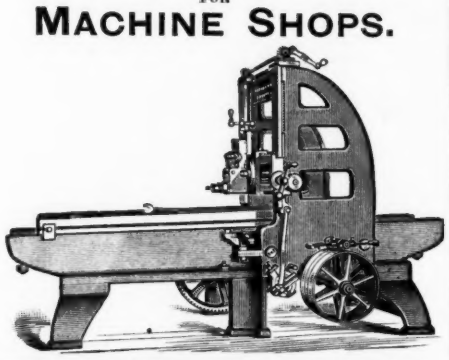

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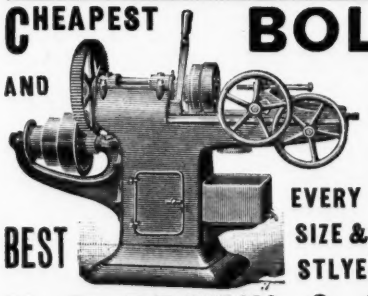

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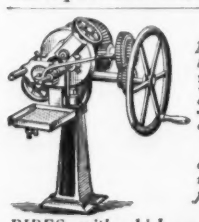

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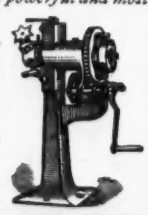

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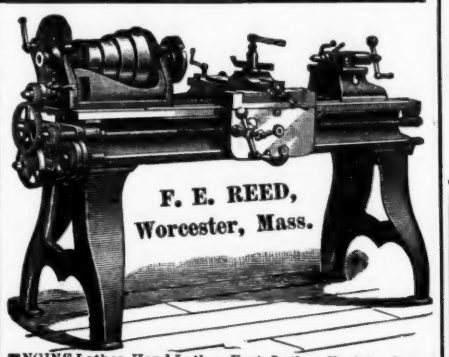

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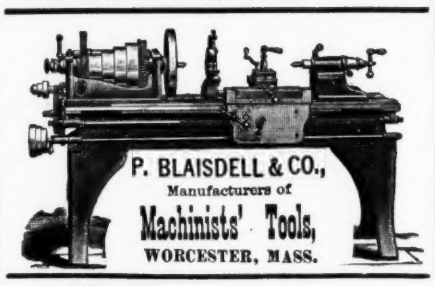

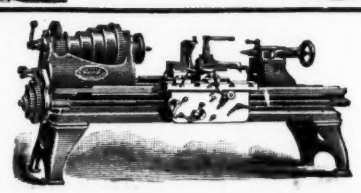

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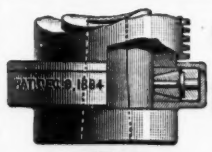

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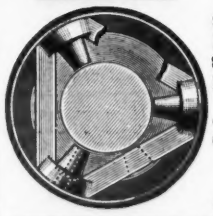

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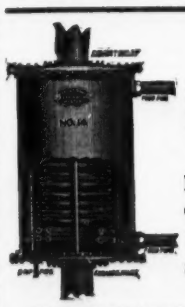

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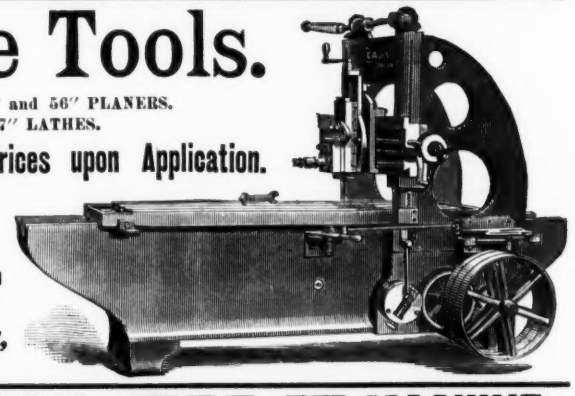

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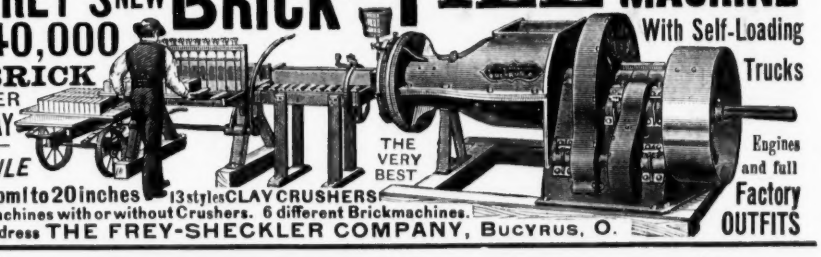

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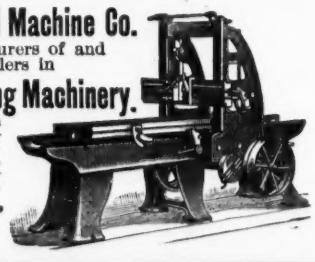

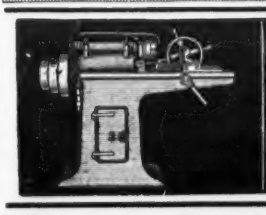

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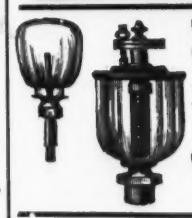

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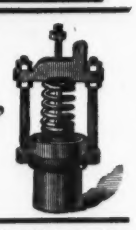

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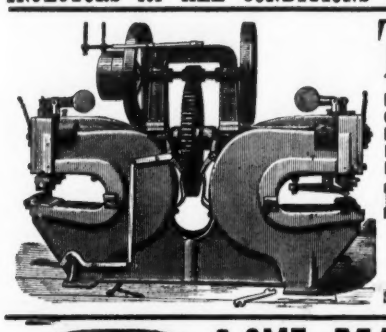

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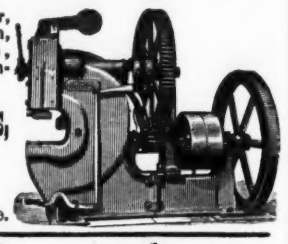

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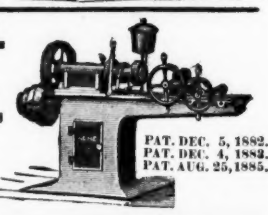
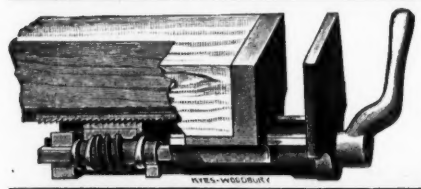


PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.



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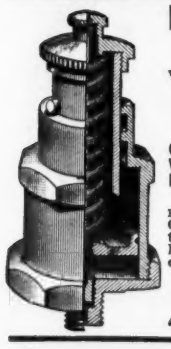

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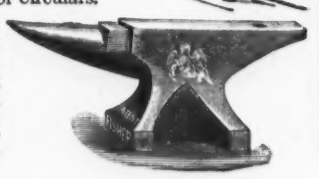

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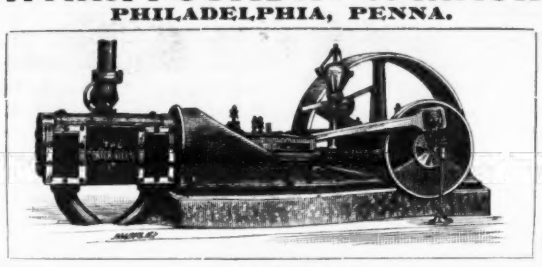

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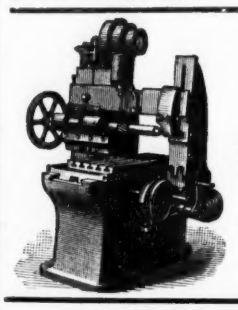

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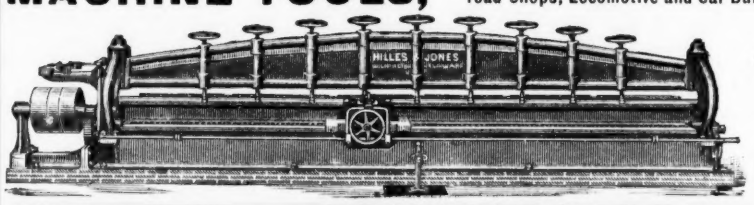

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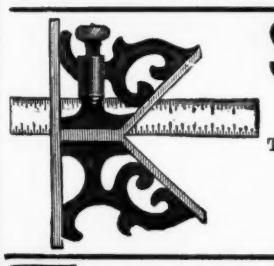

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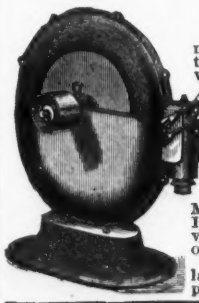

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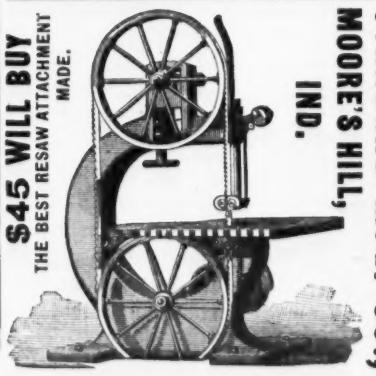

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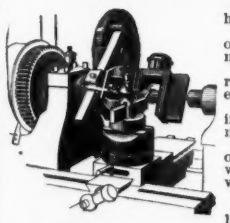

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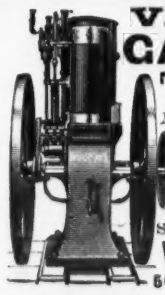

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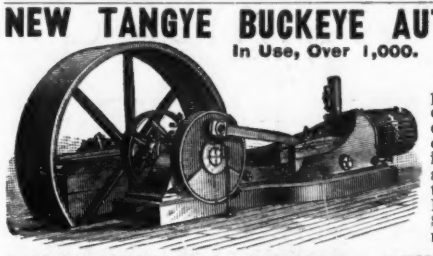

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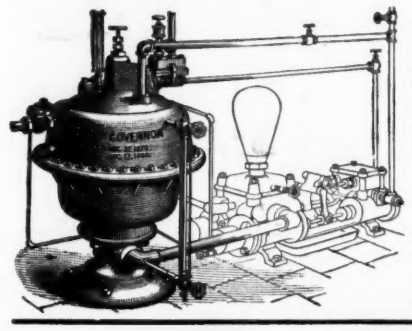

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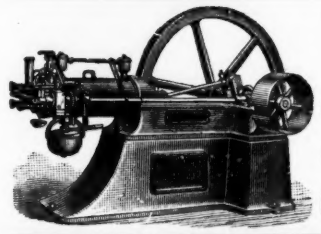

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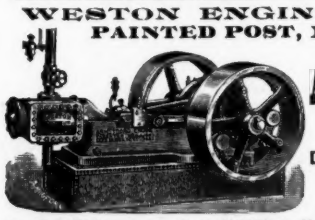

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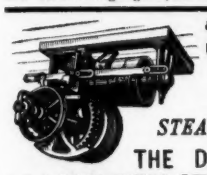

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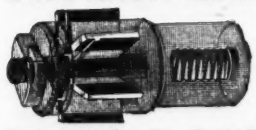

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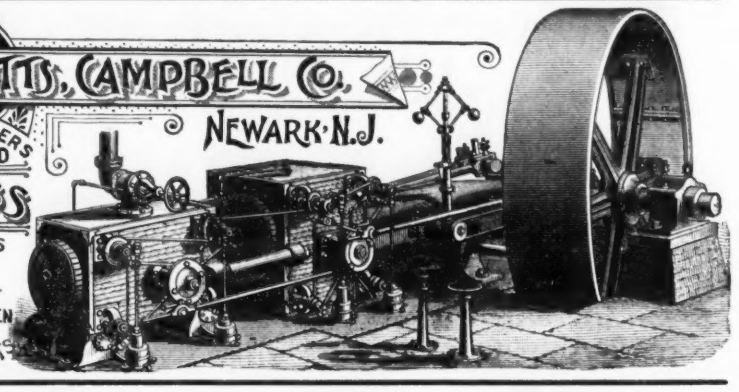

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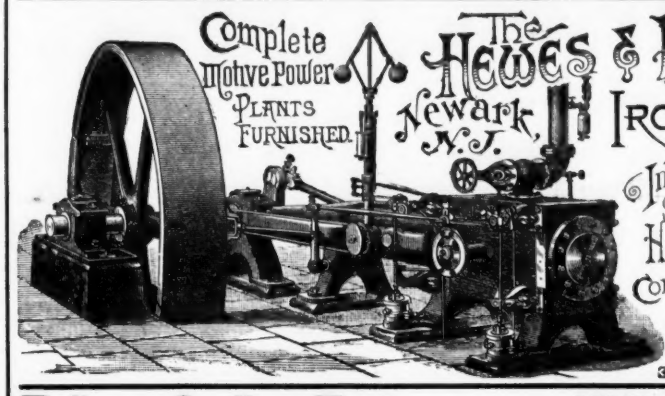

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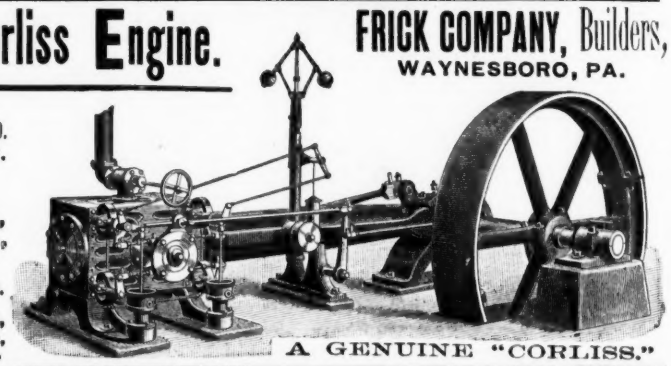

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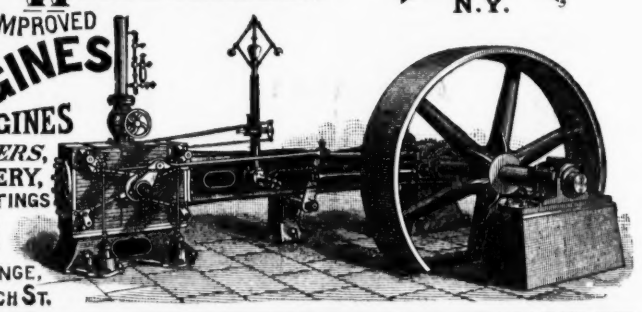

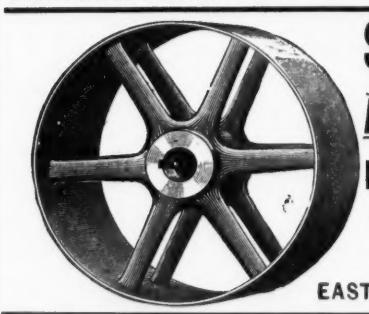

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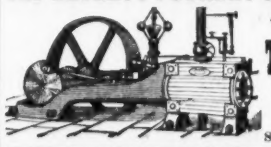

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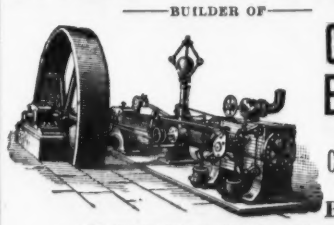

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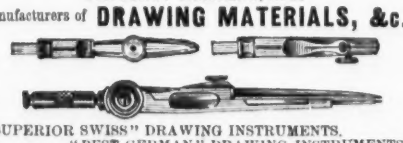

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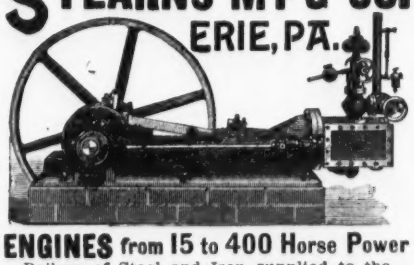

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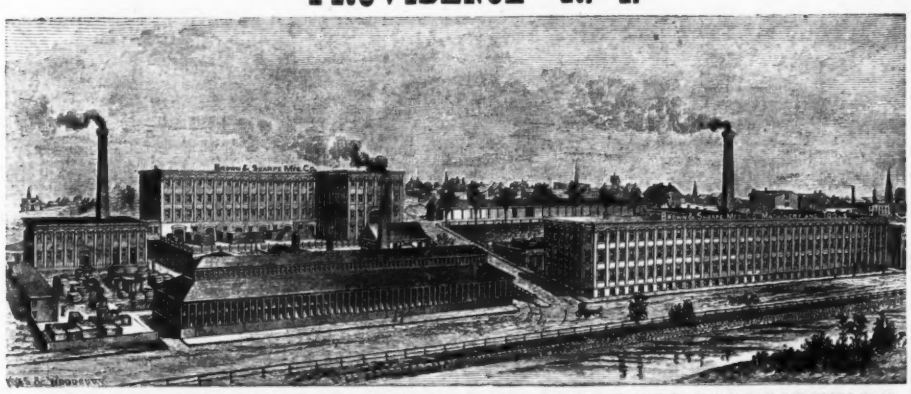

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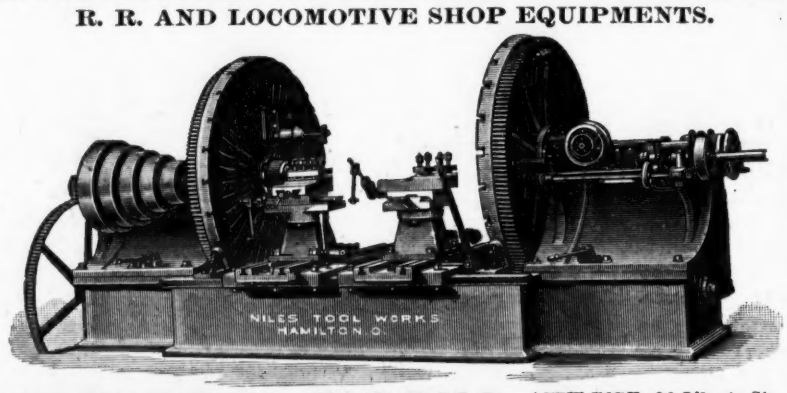

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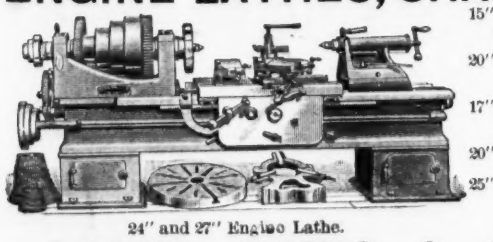

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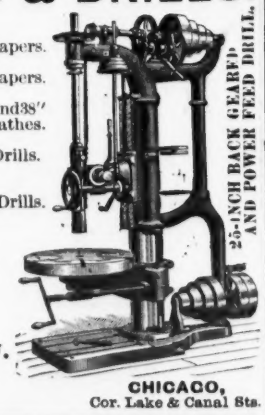

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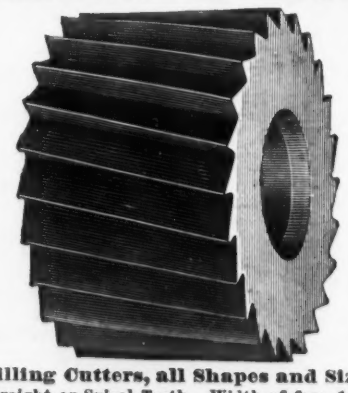

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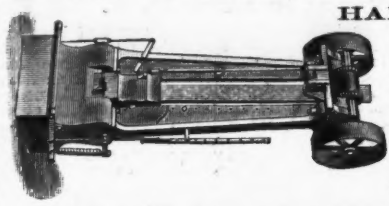

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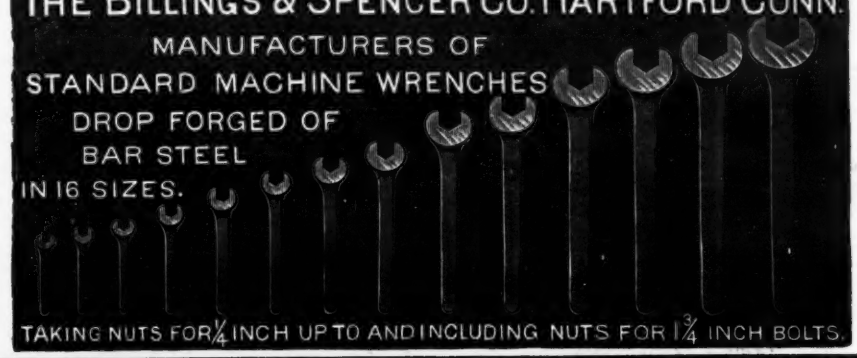

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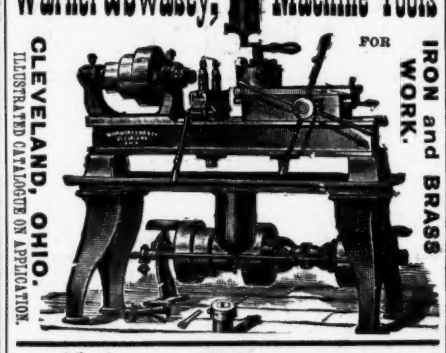

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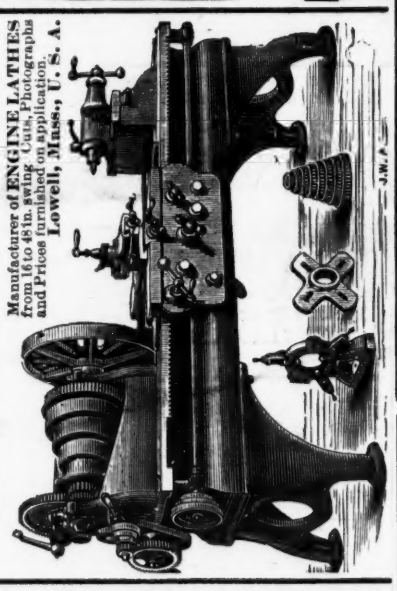

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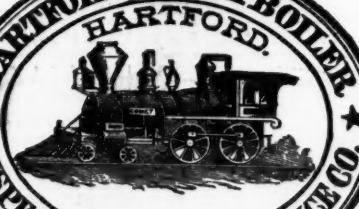

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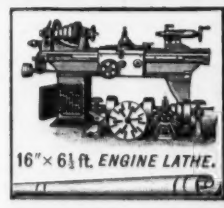

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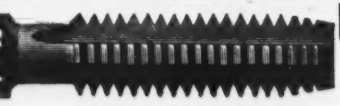

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